Tehnix®

EKO INDUSTRIJA

TEHNOLOŠKI PRIRUČNIK ZA BIOREAKTORSKO KOMPOSTIRANJE U KONTROLIRANIM UVJETIMA INOVATIVNOM TEHNOLOGIJOM TEHNIX

TEHNIX JE VAŠ PARTNER U SAVJETOVANJU, PROJEKTIRANJU, PROIZVODNJI I OBUCI KORISNIKA ZA PROIZVODNJU EKO KOMPOSTA

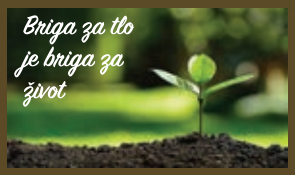
Europska unija
Zajedno do fondova EU

REPUBLIKA HRVATSKA
Ministarstvo regionalnoga razvoja i fondova Europske unije

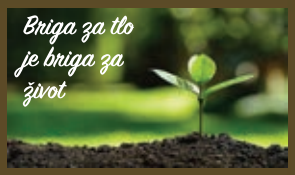
EUROPSKI STRUKTURNI I INVESTICIJSKI FONDOVI

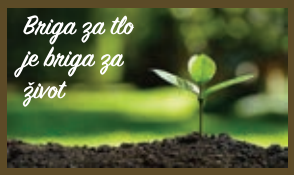
Operativni program KONKURENTNOST I KOHEZIJA

TISKANO IZDANJE
BROJ 1
6/2021



SADRŽAJ





Poštovani partneri i suradnici u proizvodnji komposta!

Više od 30 godina poznati smo na tržištu kao pouzdan proizvođač komunalne opreme. Na sljedećim stranicama želimo Vam predstaviti INOVATIVNU TEHNIX TEHNOLOGIJU BIOREAKTORSKOG KOMPOSTIRANJA I PROIZVODNJE EKO KOMPOSTA. Nadamo se da ćete pronaći potrebne informacije u ovom priručniku te Vas ujedno pozivamo na zajedničku suradnju u budućnosti kako bi zajedno doprinijeli održivosti planete Zemlje, našeg zajedničkog doma.

Đuro Horvat, predsjednik kompanije Tehnix,
izumitelj projekta bioreaktorskog kompostiranja
Akademija tehničkih znanosti Hrvatske
Fakultet kemijskog inženjerstva i tehnologije

PATENT BR. D20210011
PATENT BR. D20210012
PATENT BR. D20210013

UVOD

Kompostiranje je jedna od najstarijih metoda reciklaže. Prije oko 2000 godina rimski učenjak i autor Columella, opisao je u njegovoj poljoprivrednoj referentnoj knjizi, kako miješati razne vrste otpada, gomilati ih na hrpe i kako ponovno upotrijebiti materijal da se poboljša kvaliteta tla (zemljišta). Postoje također indikacije da je organski otpad već metodički kompostiran i pretvoren u gnojivo u Kini prije više od 3000 godina. Rimljani su skovali naziv „composta“ (tal. sastavljen), iz kojeg je potekao sadašnji naziv kompost. Prednosti tog prirodnog, biološkog procesa za preradu bio-otpada su zaboravljene već duže vrijeme. Samo raste svijest o zaštiti okoliša, koja rezultira zakonima I povećanjem troškova pravilnog odlaganja otpada, što znači da je kompostiranje doživjelo preporod u mnogim zemljama sredinom prošlog stoljeća kao osjetljiva metoda odlaganja otpada. Brz rast kompostiranja na jednu od najraširenijih metoda obrade organskog otpada započeo je početkom 70-tih godina. U Republici Hrvatskoj kompostiranje je na početku. Najčešće korištena metoda je metoda kompostiranja na hrpe ili brazde na otvorenom. Organski otpad iz različitih izvora je miješan, stavljen na brazde i tada se razgrađuje pomoću doziranja bioaktivenata u kontroliranim aerobno biološkim procesima. Konačni proizvod, kompost obogaćen hranjivim tvarima i prekriven preko područja koja zahtijevaju gnojenje i stoga upotpunjuje prirodni ciklus proizvodnje zdrave hrane.

POSLOVNI KONTAKT

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ZNANJEM OD ODLAGALIŠTA DO ODRŽIVE BUDUĆNOSTI

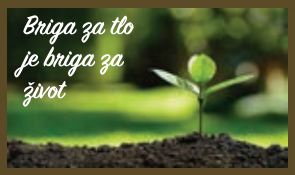
Kompanija Tehnix zajedno s partnerom Fakultetom kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu te ekspertima Akademije tehničkih znanosti Hrvatske i vodećim stručnjacima sa strukovnih fakulteta preuzeli su projektnu obavezu iz EU fondova za unapređenje tehnološkog sustava kompostiranja biorazgradivog otpada kao značajnog zagađivača okoliša. Projekt ugovora o razvoju nove tehnologije bioreaktorskog kompostiranja potpisan je 12.03.2018. godine te je takva stručno razvojna obaveza dala kreativnu slobodu i veliko zaduženje da teoretske spoznaje pretvori u suvremenu potrebnu praksu, koja će značajno unaprijediti dosadašnji manufakturni način proizvodnje i uporabe biorazgradivog otpada, tako da se najvećim dijelom biorazgradivi otpad odlagao na neuređene deponije ili kasnije na skupa uređena odlagališta.

SAMO 8 TJEDANA

KRUŽNA EKONOMIJA

Stručni tim za razvoj TEHNIX pogona za bioreaktorsko kompostiranje biorazgradivog komunalnog otpada

NAŠ CILJ JE ČISTI OKOLIŠ I ODRŽIVI RAZVOJ
TEHNIX d.o.o., www.tehnix.com, tehnix@tehnix.com, +385 40 650 100

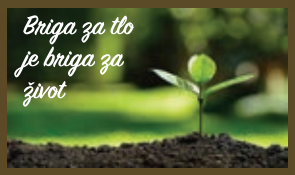


Temeljna ideja i znanstvena obaveza u početku se činila provedivom i ekološki nužnom s obzirom na štetnost dosadašnjeg načina odlaganja velikog udjela biootpada i zagađenja prostora te negativnog utjecaja na klimatske promjene i zagrijavanja Planete. U početku provedbenog projekta činilo se da to nije tako opsežan i zahtjevan projekt. Razradom potrebnih inovativnih tehnoloških potreba utvrdili smo da inovativne ideje treba pretvoriti u stvarne, tehnološki lako provedive, operativne procese koji će u što kraćem vremenu sa što manjim troškovima, ideje pretvoriti u tehnološku stvarnost provedivu u praksi. Dobra radna atmosfera, eksplozivna motivacija svih sudionika na projektu, postupno od konzultantskih sastanaka do početnih proizvodnih rezultata pojedinih strojeva, davali su dodatni poticaj u postizanju operativnih cjelina istražujući tehnološka rješenja kojima se mogu postići zadani ciljevi.

Zajednički smo utvrdili da se tehnološka obrada mora provoditi u kontroliranim uvjetima, što je značilo da trebamo projektirati tipske montažne projekte koji imaju sve građevinske i prostorne uvjete, u kojima se mogu razvijati biološko-tehnološki procesi, koristeći sve propisane norme kojima postižemo brzu i kvalitetnu proizvodnju biorazgradivog otpada te ga u vremenu od 6-8 tjedana pretvaramo u kvalitetno eko gnojivo za postizanje obogaćenja tla za novi agro ciklus. U srednjoj fazi odvijanja i razvoja tehnologije utvrdili smo da idemo u dobrom smjeru jer smo laboratorijskom analizom utvrdili da dobiveni produkt, **eko kompost**, ima velike mineralne vrijednosti u proizvodnji zdrave hrane, osobito zbog vraćanja FOSFORA, NITRATA I KALCIJA u novi ciklus eko proizvodnje.

Potaknuti početnim pozitivnim rezultatima povećali smo motiviranost u traženju operativnih rješenja kojima možemo postići operativne i tehnološke rezultate. Najveće tehnološke pomake postigli smo upravo kroz konzultantske rasprave u razvoju pojedinih strojeva i njihovih radnih kapaciteta uz što manji utrošak energije i vremena, odnosno manje troškove u razvoj nove tehnologije kojom ćemo ulaganje u eko kompostiranje učiniti ekonomski isplativim, ekološki održivim i socijalno naprednim.

Naši ciljevi su bili ambiciozni, ali pojedinačno neprovedivi. Financiranjem tako značajnog razvojnog projekta od strane Republike Hrvatske i Europske komisije ostvarili smo globalne ciljeve neprocjenjive vrijednosti, kojima ćemo značajno doprinijeti održivosti planete Zemlje. Europska komisija u stvaranju zelenog plana EU istaknula je činjenicu da je **briga za zdravo tlo, briga za život,** dakle tlo je resurs koji moramo čuvati od zagađenja, obogaćivati ga bio gnojivima proizvedenim na tvornički način, uz što manje troškove, koristeći u proizvodnji što manje energije i vremena, stvarajući nova radna mjesta, čuvajući pitke vode kao značajni neobnovljivi resurs. Najvažnije je proizvoditi na zdravoj zemlji zdravu hranu. Sada kada nemamo odgovor na pitanje pandemija koje su najveće zlo sadašnjice, a nastale su i zbog klimatskih promjena, pokušavamo beskonačnom srećom opravdati zajednički trud svih sudionika tog projekta za koji mislimo i vjerujemo da spada u opće dobro svih ljudi na planeti Zemlji, koja je naš zajednički dom.

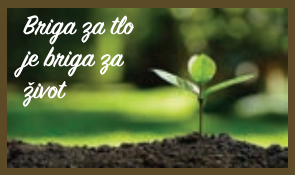


Izum se odnosi na bitno usavršeni tehnološki postupak kojim se postiže skraćenje proizvodnje komposta sa 6 na 2 mjeseca, a povećava se kvaliteta dobivenog eko komposta koji, obogaćen fosfatom obogaćuje plodnost zemlje i omogućuje proizvodnju zdrave hrane. Tehnološki postupak je unaprijeđen tako da je na specijalnom stroju za prevrtanje brazdi ugrađen rezervoar za prihvat čiste vode obogaćene kisikom i aktivnim bioaktiventima iz oborinskih voda s krovišta hala u prihvatni bazen unutarnje hale. Na stroju za prevrtanje brazdi ugrađen je operativni sekundarni rezervoar od 1 do 2 m^3 zavisno od kapaciteta kompostane te dimenzije i dužine brazdi za prevrtanje. U rezervoaru se nalaze dva difuzora za aeraciju vode u koju se na početku kompostiranja dodaju aktivni bioaktiventi razvijeni u specijaliziranim laboratorijima za proizvodnju komposta. Niskotlačnim kompresorom dodajemo zrak u rezervoar te potiskom na površinu vode stvaramo tlak do 0,3 bara koji nam omogućuje da vodu obogaćenu kisikom i bioaktiventima ubacujemo u prostor na kojem se vrši miješanje i prozračivanje brazdi.

U takvom postupku miješanja vršimo nekoliko bitnih operacija kojima se ubrzava postupak proizvodnje eko komposta, ravnomjerno i sveobuhvatno dodavanje bioaktivenata na biomasu gdje se nalaze dvije dizne raspoređene pod kutem od 45 °C tako da okretanjem rotora i lopatica na rotoru ubacujemo zrak u brazde, dodajemo aktivne bioaktivente, ravnomjerno ih raspoređujemo po površini pripremljene usitnjene biomase postupkom drobljenja, tako da bioaktiventi uđu u dubinu drobljene biomase. To omogućuje brzu i intenzivnu bioreakciju proizvodnje eko komposta u kontroliranim uvjetima u natkrivenim i prozračivanim prostorima u kojima se odvija brzo zrenje kompostne mase koja se grije bioaktiventima do temperature od 70 °C, kada se prevrtanjem vrši pothlađivanje i dozrijevanje biomase u vremenu od 6 tjedana, a dva tjedna ostaje za sazrijevanje, pothlađivanje, prosijavanje, čišćenje i pakiranje eko komposta.

Takav postupak bioreaktorskog kompostiranja razvojem nove tehnologije ima ogromne ekološke, ekonomske i socijalne prednosti od do sada poznatih i korištenih tehnologija u proizvodnji eko komposta:

1. Ostvarujemo politiku zelenog plana EU I RH
2. Ne odlažemo neobrađenu biomasu na deponije jer je to skupo i zagađuje okoliš;
3. Ne gradimo skupa odlagališta otpada za odlaganje bio mase koja stvara smrad;
4. Ne zagađujemo podzemne pitke vode na neuređenim deponijama;
5. Ne trebamo skupe uređaje za pročišćavanje vode iz deponije otpada;
6. Nema neugodnih mirisa iz natkrivenih eko kompostana;
7. **Proizvodimo kvalitetno eko gnojivo obogaćeno mineralima;**
8. Proizvodimo zdravu hranu za zdrav život ljudi;
9. Bitno smanjujemo štetne emisije i klimatske promjene planete Zemlje;
10. Postižemo ciljeve kružne ekonomije, održivi razvoj i ciljeve zelenog plana RH i EU.

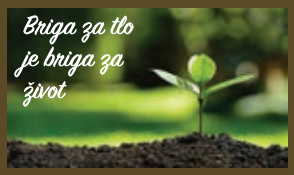


Postupak bioreaktorskog kompostiranja omogućuje kontroliranu kvalitetnu pripremu biomase za kompostiranje. Tehnološki definirani postupak proizvodnje eko komposta i natkriveni prostor eko kompostane omogućuju kontrolirano provođenje procesa bioreaktorskog kompostiranja, što znači da u svakoj tehnološkoj fazi proizvodnje komposta imamo kontrolirane procese sazrijevanja bez neugodnih mirisa. Kompanija Tehnix zajedno s ekspertima iz Fakulteta kemijskog inženjerstva Zagreb i Akademije tehničkih znanosti Hrvatske razvila je, ispitala u praksi te proizvodi kompletnu tehnologiju za bioreaktorsko kompostiranje te tako garantira da u propisanim tehnološkim uvjetima, koristeći najsuvremeniju tehnologiju, uz stručni nadzor i primjenu tehnologije postupka, **proces bioreaktorskog kompostiranja ne proizvodi neugodne mirise i nije štetan za okoliš.**

Pogon za bioreaktorsko kompostiranje sastoji se od nekoliko slijednih tehnoloških cjelina:

1. BIO ŠREDER SA DOZATOROM KRANOM tip TEHNIX, 3 tipa.
2. SPECIJALNI STROJ KOMPOSTDER za prevrtanje brazdi 3 tipa.
3. KOMPOST ROTO SITO za prosijavanje komposta 3 tipa.
4. MOBILNI DOZATOR za proizvodnju komposta, pretovar i doziranje 3 tipa.
5. SUSTAV ZA PAKIRANJE ZRELOG KOMPOSTA U VREĆE OD 50 LITARA 2 tipa.
6. AEROBNI SUSTAV za pripremu oborinskih bazenskih voda.
7. ROTO EKO KOMPOSTER TEHNIX 120/900 mm.
8. UREĐAJ ZA RECIKLAŽU STAROG NAMJEŠTAJA, AUTOGUMA i ostalog krutog otpada.

Takva funkcionalna cjelina je tehnološko unaprjeđenje industrijskog postupka kompostiranja koja razvojem strojeva i njihovom integracijom nudi funkcionalnu cjelovitost tehnološkog rješenja jer je omogućena potpuna strojna obrada - od dopreme komunalnog otpada organskog podrijetla do gotovog sekundarnog proizvoda, unaprjeđenjem tehnoloških postupaka razvijen je ekološki potpuno prihvatljiv postupak biološke obrade otpada organskog podrijetla (kontrolirani biološko-aerobni uvjeti), skraćen je proizvodni ciklus sa 180 dana na 60 dana, racionalizirani su proizvodni resursi (smanjenje troškova proizvodnje, smanjenje potrebnog proizvodnog prostora, recikliranje i ponovno korištenje proizvodnih resursa (tehnološka i oborinska voda), a tehnološko rješenje približeno je ciljanom konceptu „nulta stopa otpada“/ „nulta stopa štetnih emisija“ (povećan udio recikliranog biorazgradivog komunalnog otpada, postupak kompostiranja koji se odvija u kontroliranim uvjetima kroz razvoj sustava recikliranja tehničke i prikupljanja oborinske vode). Kao rezultat projekta došlo je do unaprjeđenja kvalitete sekundarnog proizvoda - eko komposta - s mogućnosti primjene u poljoprivredi i uređenju okoliša (proizvodnja energetskih kultura i sanacija devastiranih terena).



EKOLOŠKE, EKONOMSKE I SOCIJALNE PREDNOSTI TEHNOLOGIJE BIOREAKTORSKOG KOMPOSTIRANJA

- Nema odlaganja neobrađene biomase na deponije jer je to skupo i neodrživo;
- Ne grade se skupa odlagališta otpada za odlaganje bio mase koja stvara smrad;
- Ne zagađuju se podzemne pitke vode na neuređenim deponijama;
- Ne trebaju skupi uređaji za pročišćavanje vode iz deponije otpada;
- Nema neugodnih mirisa iz natkrivenih bio kompostana;
- Proizvodi se kvalitetno eko gnojivo za poljoprivredu obogaćeno fosfatom;
- Bitno se smanjuju štetne emisije i klimatske promjene planete Zemlje;
- Postižu se ciljevi kružne ekonomije u gospodarenju otpadom.

Proces bioreaktorskog kompostiranja ne proizvodi neugodne mirise i nije štetan za okoliš uz poštivanje tehnologije kompostiranja u natkrivenom puluzatvorenom sustavu sa specijalnim strojevima u kontroliranim uvjetima, a dobiveni produkt je kompost I. klase obogaćen fosfatom!

BIOREAKTORSKO KOMPOSTIRANJE BIORAZGRADIVOG KOMUNALNOG OTPADA

IRI I - RAZVOJNI PROJEKT KOMPANIJE TEHNIXI PARTNERA FKIT

OD 03/2018 - 3/2021

POSLOVNI I STRUČNI TIM NA OTVARANJU ŠKOLE KOMPOSTIRANJA
ZA OBUKU RUKOVODITELJA ZA UPRAVLJANJE KOMPOSTANAMA

NAŠ CILJ JE ČISTI OKOLIŠ I ODRŽIVI RAZVOJ
TEHNIX d.o.o., www.tehnix.com, tehnix@tehnix.com, +385 40 650 100

KOMPOST ROTO SHREDDER

ROTO SHREDDER - AUTOMATIK SA DOZATOROM				
TIP	SNAGA	PROMJER ROTORA	DUŽINA	UPRAVLJANJE
KRS-1000	105 kW	1000 mm	2500 mm	Daljinsko
KRS-1100	160 kW	1000 mm	2500 mm	Daljinsko
KRS-1200	210 kW	1200 mm	2500 mm	Daljinsko

Takav jedinstveni stroj ima temeljnu funkciju dobre pripreme zelene mase ili drvene mase, granja, lišća, otpadne trave, sve ono što se u jednom gradu dobije od održavanja parkova, granje drveća debljine do 120 mm i drugog krupnog organskog otpada. Tako pripremljeni usitnjeni otpad odličan je akumulator za miješanje sa prehrambenim otpadom iz komunalnog otpada te tako nastaje kvalitetna smjesa za idealnu proizvodnju komposta. Cijeli stroj ROTO-SHREDDER predstavlja samostalnu tehnološku trajnu funkcionalnu cjelinu kojom poslužic pomoću daljinskog upravljača sa radio vezom upravalja, dozira i usitnjava zeleni otpad koji zauzima puno prostora te predstavlja opasnost za požare i smještaj glodavaca. Stroj jednostavno i učinkovito proizvodi usitnjenu biomasu za kvalitetan kompost. Diesel motori snaga 105 kW / 160 kW / 210 kW dovoljni su za pokretanje specijalne višestupanjske hidrauličke pumpe visokog pritiska koja pokreće sve funkcije potrebne za doziranje, šrediranje, transport obrađenog materijala. Stroj je mobilan te ima sve tehnološke funkcije za samostalno obavljanje operacija usitnjavanja I opremljen je dozirnim automatskim kranom, izmjenjivim noževima, masivnim rotorom za usitnjavanje, sustavom podvozja na gusjenicama, te magnetnim separatorom sa permanentnim magnetom za izvlačenje metala.

TEHNIČKE KARAKTERISTIKE = MALA POTROŠNJA GORIVA, VELIKI UČINAK

NAŠ CILJ JE ČISTI OKOLIŠ I ODRŽIVI RAZVOJ

BILJEŠKE

BIO BRAZDER

SPECIJALNI UREĐAJ ZA PREVRTANJE BRAZDI, DODAVANJE BIOAKTIVENATA, VODE I ZRAKA

BIO BRAZDER - SPECIJALNI UREĐAJ ZA PREVRTANJE BRAZDI, DODAVANJE BIOAKTIVENATA, VODE I ZRAKA					
TIP	SNAGA	PROMJER ROTORA	ŠIRINA BRAZDE	VISINA BRAZDE	VOLUMEN BIOAKUMULATORA
BBT-2300/73	75 kW	400 mm	2300 mm	1000	700
BBT-2800/105	105 kW	400 mm	2800 mm	1250	1500
BBT-3500/160	160 kW	400 mm	3500 mm	1500	2000

SPECIJALNI STROJ BIO BRAZDER za obradu bio mase formira trapezoidnu brazdu, te okretanjem rotora aerira, navlažuje i obogaćuje bio-masu bioaktiventima. Dimenzije brazdi ovise o tipu I veličini stroja. Stroj ima samostalnim pogonom pomoću diesel agregata snaga 78 kW / 105k W / 210 kW te ugrađeni sustav za dodatno ovlaživanje I obogaćivanje kompostne hrpe - BIOAKUMULATOR. Operater strojem upravlja pomoću elektrohidrauličnih komandi iz zatvorene, ostakljene kabine pozicionirane na gornjem dijelu sa bočnim pristupom. Takav položaj kabine osigurava kvalitetnu preglednost radnog okružja. Strojem se kontrolira proces raspadanja bio-razgradive mase i vrlo je jednostavan za korištenje uz minimalno održavanje. Tijekom procesa prevrtanja, stroj čini trapeznu brazdu kao najprikladniji oblik za obradu bio-razgradive mase. U toku procesa raspadanja omjer zraka-vode-zemlje kompostne hrpe se mijenja zbog mikrobnog raspadanja i prirodno postavljenih učinaka. Da bi se osigurali redovni i homogeni uvjeti za raspadanje cijele hrpe, potrebno je i važno redovno okretanje i navlaživanje biomase. Kao rezultat okretanja i navlaživanja, materijal se olabavljuje, dopušta prodiranje kisika. Mikrobna aktivnost je još jednom stimulirana, što rezultira povećanjem temperature. Zbog prodora novog kisika u hrpu, sprečavaju se anaerobne zone i anaerobni procesi te smrad. U toku okretanja suhe i vlažne zone hrpe su pomiješane, a razina vlage je izjednačena. Okretanje također osigurava viši stupanj homogenosti i kvalitete komposta sa ponavljanim miješanjem i redovitim raspadanjem. S prednje strane ugrađeni su podni čistači biomase.

NAŠ CILJ JE ČISTI OKOLIŠ I ODRŽIVI RAZVOJ

BILJEŠKE

KOMPOST SITO

TIP TEHNIX ZA ČIŠĆENJE I PROSIJAVANJE KOMPOSTA

KOMPOST SITO - TIP TEHNIX ZA ČIŠĆENJE I PROSIJAVANJE KOMPOSTA				
TIP	SNAGA	PROMJER SITA	DUŽINA SITA	PERFORACIJA SITA GRUBO / FINO
KS-2000/45	45 kW	1920 mm	2000 mm	☐ 25x35 / ☐ 10x25
KS-3000/60	73 kW	1920 mm	3000 mm	☐ 25x35 / ☐ 10x25
KS-4000/73	105 kW	1920 mm	4000 mm	☐ 25x35 / ☐ 10x25

KOMPOST SITO specijalni mobilni stroj za prosijavanje komposta sa izmjenjivim rotacijskim sitom za grubo I fino prosijavanje. Kompost se prosijava u rotacijskom situ promjera Ø 1920 mm sa otvorima za prosijavanje za grubu frakciju ☐ 25x35 mm te finu frakciju ☐ 10x25 mm. Kompost sito je kompaktan uređaj za efikasno prosijavanje komposta sa diesel motorima snaga 45 kW / 73 kW / 105 kW koji pogone višestupanjsku hidrauličku pumpu. Stroj ima prihvatnu komoru sa dozirnim transporterom te ugrađenim hidrauličkim sustavom za pozicioniranje. Po unutarnjem obodu rotacijskog sita postavljena je spirala koraka 500 mm kako bi se materijal što kvalitetnije prosijavao te istovremeno transportirao prema izlazu iz rotacijskog sita. Prosijani kompost pada ispod sita na uzdužni tračni transporter a gruba neprosijana frakcija odnosi se sa poprečnim pužnim transporterom na izdvojenu hrpu. Brzina rotacije sita se može regulirati u rasponu od 5 - 15 okretaja u minuti. U gornjem dijelu konstrukcije stroja duž rotacijskog sita ugrađena je čelična četka za čišćenje vanjskog oboda rotacijskog sita sa sustavom za podešavanje nagiba. Brzina rotacije zavisna je od stupnja vlažnosti i kvalitete zrelosti komposta.

BILJEŠKE

MOBILNI DOZATOR

FARESIN = TEHNIX

MOBILNI DOZATOR - FARESIN = TEHNIX				
TIP	SNAGA	VISINA PODIZANJA	MAX. NOSIVOST	RADIJUS OKRETANJA
6.26 CLASSIC	52 kW	6000 mm	2600 kg	3250 mm
7.30C CLASSIC 75	75 kW	7000 mm	3000 kg	3870 mm
8.40 HLS 103	103 kW	8000 mm	4000 kg	4150 mm

MOBILNI DOZATOR za manipulaciju biorazgradivim otpadom te gotovim kompostom, pretovar i doziranje iz gotovih brazdi komposta u roto sito te iz roto sita u postrojenje za pakiranje komposta u vreće. Stroj je pogonjen diesel motorom te potpuno automatskim hidrostatskim prijenosom sa dvije mehaničke brzine te duplim FNR Control sustavom i prekidačem na volanu ili na upravljačkoj ručici od hidraulike. Maksimalna brzina kretanja iznosi 40 km/h. Ugrađen je servo upravljani kočioni sustav, automatsko reduciranje brzine vožnje ovisno o visini podignutog teleskopa. Upravljačka kabina QUEEN CAB proizvedena je prema dozvolama ROPS-FOPS standarda sa Multifunkcionalnim displejom sa dijagnostikom, klimauređajem, ventilacijom i grijanjem, te pripremom za radio uređaj i LED radnim svjetlima. Pristup kabini omogućen je sa duplim vrata sa mogućnošću otvaranja gornjeg dijela. Hidraulično brzo kopčanje priključaka.

DODATNA OPREMA:

1. Specijalna utovarna korpa za lake materijale kapaciteta 1,5 m^3
2. Specijalna utovarna korpa s grabilicama za granje kapaciteta 2 m^3
3. Nosač vilica sa vilicama za prijenos tereta

TEHNIČKE KARAKTERISTIKE: BRZ, OKRETAN, ŠTEDLJIV

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BILJEŠKE

POSTROJENJE ZA DOZIRANJE I ZA PAKIRANJE KOMPOSTA U VREĆE

POSTROJENJE ZA DOZIRANJE I PAKIRANJE			
TIP	INSTALIRANA SNAGA	DOZIRNI TRANSPORTER	KAPACITET PUNJENJA
PAK-T50/1	4 kW	DIREKTNO DOZIRANJE	do 3 m^3 / h
PAK-T50/2	10 kW	(2500 + 4300) x 1200 - 40 °	do 5 m^3 / h

POLUAUTOMATSKI SUSTAV ZA PAKIRANJE U VREĆE. Pakiranje se vrši u vreće za kompost volumena do 50 litara za prodaju i korištenje u poljoprivredi. Postrojenje se sastoji od prihvatnog kutnog lančanog transportera, prihvatnog grotla sa dvostrukim pužnim dozatorom, mjernih dozatora te izlaznog lančanog transportera sa uređajem za šivanje vreća. Uređaj omogućuje brzo I precizno punjenje vreća volumena 50 litara.

TEHNIČKE KARAKTERISTIKE = JEDNOSTAVNOST I FUNKCIONALNOST

NAŠ CILJ JE ČISTI OKOLIŠ I ODRŽIVI RAZVOJ

BILJEŠKE

EKO KOMPOSTER

MALI DIV - VELIKI UČINAK
HRVATSKI PROIZVOD ZA SVAKOGA

ROTO EKO KOMPOSTER TEHNIX 120/900 mm. To je specijalni stroj za pripremu bio mase, drva, oblice te starih gredica koje se nalaze u krutom komunalnom otpadu. On ima ogromne prednosti od dosada poznatih rješenja. Takav stroj je mobilan i predstavlja novu tehnološku cjelinu. Debele grane Ø 20-120 mm, samostalnim uvlačenjem režu oblice ili grede, usitnjavaju ih na dužinu od 10-25 mm, drobe ih sustavom ventilatora, izbacuju u specijalne kontejnere ili vreće za prihvat biomase. Pogonska snaga je 60 kW, a koristi se isti pogonski stroj kao i kod bio šredera. Konstrukcija ROTO EKO KOMPOSTERA mora zadovoljiti tehnološke ciljeve koji će omogućiti obavljanje planiranih tehnoloških zadataka. Posebno će naglasak biti na sigurnosti rada stroja. Cilj je da cijeli stroj bude vučno mobilan, tako da se planirane operacije mogu obavljati uz kompostanu na otvorenom ili u natkrivenom prostoru. Kompletni pogonski sustav treba biti preko hidrauličnih motora tako da nema mogućnosti strujnog udara.

TEHNIČKE KARAKTERISTIKE = JEDNOSTAVNOST I EKONOMIČNOST

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BILJEŠKE

UREĐAJ ZA RECIKLAŽU STAROG NAMJEŠTAJA

UREĐAJ ZA RECIKLAŽU STAROG NAMJEŠTAJA i ostalog krutog otpada, za kompostiranje, usitnjavanje, drobljenje krutog organskog otpada za proizvodnju eko komposta, zamišljen je kao suvremeni proizvod specijalne namijene za usitnjavanje i drobljenje krutog drvenog i organskog otpada u tehnološkom procesu kompostiranja i proizvodnji eko-komposta. Stroj funkcionira kao samostalna tehnološka cjelina i namijenjen je za rad u natkrivenom prostoru, odnosno u uvjetima kada su vremenske prilike povoljne (bez oborina). Jednostavan je za prijenos i pogodan za smještaj na različitim lokacijama. Materijal (stari namještaj, vrata, prozori, ...) koji je namijenjen za reciklažu potrebno je usitniti, odnosno razlomiti na manje komade, te nakon toga uključiti u proces bioreaktorskog kompostiranja. Rad uređaja i upravljanje trebaju biti vrlo jednostavni čime smanjujemo mogućnost kvara i oštećenja dijelova, a sam uređaj mora biti funkcionalan i ekonomičan. Usitnjavanje vrše rotacioni noževi izrađeni od specijalnog čelika smješteni na dva heksagonska vratila. Uređaj pogoni elektromotor snage 15 kW. Snaga s elektromotora prenosi se na primarno vratilo pomoću planetarnog reduktora.

Okretanjem noževa kruti i organski otpad se reže/usitnjava na frakciju debljine do 30 mm i pada na izlazni transporter koji istu odvodi u kontejner zapremine do 7 m^3. Upravljanje uređajem vrši se preko elektro-upravljačkog ormara sa ergonomski raspoređenim upravljačkim komandama. Predviđene dimenzije kućišta sa rotirajućim noževima su 1100 mm dužine, 725 mm širine, i 500 mm visine sa 33 kompleta noževa. Kapacitet uređaja iznosi do 4 m^3/h krutog organskog otpada. Pogodno za proizvodnju toplinske energije.

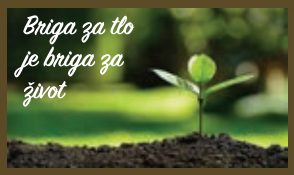
BILJEŠKE

AEROBNI SUSTAV

KONTROLNI UPRAVLJAČKI KONTEJNER S OPREMOM

AEROBNI SUSTAV za pripremu oborinskih bazenskih voda. Postrojenje je opremljeno sa aeratorima - dozatorima zraka. U sustavu treba izvesti specijalni dozator bioaktivenata koje se aktiviraju u aerobnim bazenima. Potrebno je izraditi stambeni kontejner kao ured u kojim će se smjestiti oprema za pripremu vode kisikom za doziranje bioaktivenata. Specijalni kontejner mora imati specijalnu opremu, odgovarajuću električnu instalaciju, priključene cjevovode za klipne kompresore, cijevne instalacije te upravljački stol za pogon postrojenja. Kontejner mora biti izoliran, opremljen sa sustavom za boravak te elektronsku informatiku. Takav sustav je direktno povezan sa bazenom od 150 m^3, koji služi za prikupljanje krovnih i površinskih voda. Pumpe za punjenje kompostdera vodom imaju gumene cjevovode kojima se brzo dozira rezervoar od 1000 litara. Potrebno je aerobni bazen opremati sa preljevnim sustavom te sustavom za dopunjavanje vodom iz javnog sustava. Izgradnjom aerobnog sustava za pripremu oborinskih voda zaokružujemo novu tehnološku cjelinu koja omogućuje eko kompostiranje biorazgradivog i organskog otpada te se isti vraća u zelenu proizvodnju. Takvom kompletnom tehnologijom postižemo kružnu ekonomiju.

BILJEŠKE

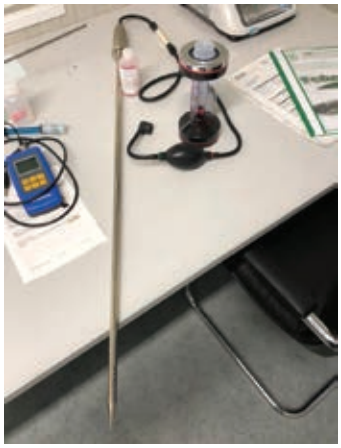


PROIZVODNJA EKO KOMPOSTA ZA 8 TJEDANA U 8 KORAKA

1. OBJEKTI INDUSTRIJSKOG KOMPOSTIRANJA ZA PROIZVODNJU EKO KOMPOSTA
2. PRIPREMA ORGANSKOG BIORAZGRADIVOG OTPADA ZA KOMPOSTIRANJE
3. FORMIRANJE BRAZDI ZA OPTIMALNI POSTUPAK PROIZVODNJE KOMPOSTA
4. BIOREAKTORSKO OKRETANJE TE DODAVANJE BIOAKTIVENATA I KISIKA
5. KONTROLA OPTIMALNE VLAŽNOSTI U PROIZVODNJI KOMPOSTA
6. PRIPREMA VODE U AERACIJSKIM BAZENIMA OBORINSKE VODE
7. KONTROLIRANJE TEMPERATURE BIOLOŠKE REAKCIJE KOMPOSTA
8. PAKIRANJE KOMPOSTA TE OBOGAĆIVANJE MINERALNIM GNOJIVIMA

BIOREAKTORSKO KOMPOSTIRANJE BIORAZGRADIVOG KOMUNALNOG OTPADA DODAVANJEM BIOAKTIVENATA

PARTNER: TEHNIX-a



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MJERNI I ISPITNI UREĐAJI ZA DODAVANJE BIOAKTIVENATA ZA PROIZVODNJU EKO KOMPOSTA U KONTROLIRANIM UVJETIMA

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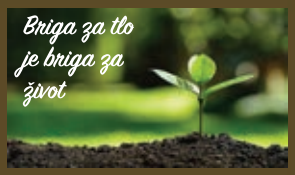
BILJEŠKE



1. OBJEKTI INDUSTRIJSKOG KOMPOSTIRANJA ZA PROIZVODNJU EKO KOMPOSTA SPECIJALNE KONSTRUKCIJE

SPECIJALNE MONTAŽNE HALE OMOGUĆUJU KONTROLIRANO ODVIJANJE TEHNOLOŠKOG PROCESA U KONTROLIRANIM UVJETIMA VAŽNO JE OSIGURATI USMJERENU CIRKULACIJU ZRAKA

Industrijsko kompostiranje mora se odvijati u kontroliranim zaštićenim uvjetima. To znači da je cijeli tehnološki proces proizvodnje eko komposta nadziran. Najvažniji dio je odrediti prostorni kapacitet brazdastog kompostiranja. Dimenzije natkrivene hale utvrđuju se prema broju korisnika i okruženju u kojem se gradi građevina za eko kompostiranje. Hala za kompostiranje mora biti opremljena vodom, strujom, opremom za proizvodnju komposta i bazenom za oborinske vode. Visina hale usklađena je sa objektom reciklaže i sortiranja komunalnog otpada. Kompostiranje spada u tehnološki proces reciklaže, što znači izdvajanje organskog i biorazgradivog materijala koji se pretvara u kvalitetno gnojivo. Važno je odrediti optimalni kapacitet prostora za bioreaktorsko kompostiranje. Krovište hale može biti od betona, panela ili limova obloženih filcom. Najekonomičnije je izgraditi halu za kompost neposredno uz sortirnicu. Sama građevina mora zadovoljiti uvjete da nema kiše, bure, snijega niti izlijevanja tekućina u prostor okolo kompostane ni u podzemne vode. Sama građevina mora biti opasana zidom visine 3 metara kako ne bi došlo do pothlađivanja burom niti ispiranja brazdi u kišnim uvjetima. Podloga hale za proizvodnju komposta treba biti nepropusna armirano-betonska, vrata trebaju omogućiti dovoz materijala i odvoz komposta. Projekt mora zadovoljiti prostorne i ekološke uvjete. Dnevna količina biorazgradivog otpada je približno 0,2 kg/stanovniku.

BILJEŠKE

2. PRIPREMA ORGANSKOG BIORAZGRADIVOG OTPADA ZA KOMPOSTIRANJE I DOBRU PRIPREMU BIOMASE

Priprema materijala za kompostiranje je najvažniji tehnološki dio proizvodnje kvalitetnog eko komposta koji se može koristiti u eko poljoprivredi. Organski otpad iz komunalnog otpada sakupljen u miješanom komunalnom otpadu ili posebno prikupljen od građana u kantama ili vrećama isto se mora tehnološki pripremiti, usitniti prije brazdiranja. Važno je da tehnologija doziranja na roto situ već ima sustav za usitnjavanje voća, povrća i drugog otpadnog organskog otpada. Posebno se tehnološki mora pripremiti granje, žbunje, grmlje, reznice drveća, kore drveta, drvene oblice do Ø 12 mm, veće dužine, božićna drvca, zelenila od čišćenja parkova, lišće, suha i zelena trava, sve se to mora usitniti odnosno sjeckati, mljeti na optimalnu debljinu i dužinu kako bi se dobila kvalitetna masa za kompostiranje. Formiranje brazdi od pripremljene zelene mase, vrši se na način da se takav materijal stavlja kao posteljica brazde, dok se na njega stavlja otpad iz domaćinstava, zatim otpad od prerade voća i povrća, komina od maslina, grožđa, dok se na vrh brazde treba stavljati otpad iz uređaja za pročišćavanje otpadnih voda. Naravno da je potrebno dobro paziti da na kompostiranje ne dođu muljevi koji su zasićeni deterdžentima, kiselinama, lužinama ili pesticidima, koji u biološkoj razgradnji imaju negativan utjecaj na razvoj bakterijskih kolonija, koje svojim aktivnostima proizvode kompost. Strojeve i opremu za pripremu biomase za proizvodnju komposta potrebno je izabrati prema optimalnoj potrebi korištenja, tako da ne troše puno goriva, nafte i ne zagađuju prostor unutar hale. Moraju biti mobilni sa sustavom za doziranje te imati certifikat za sigurnost na radu.

BILJEŠKE

3. FORMIRANJE BRAZDI ZA OPTIMALNI POSTUPAK PROIZVODNJE KOMPOSTA

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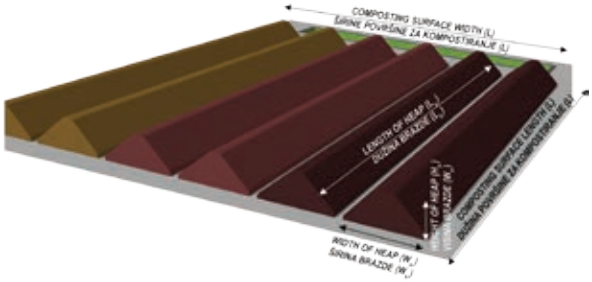


Formiranje brazdi za proizvodnju eko komposta ključno je za daljnji proces kvalitete biološke razgradnje u postupku bioreaktorskog kompostiranja. Brazdiranje u planiranu brazdu optimalne dimenzije prema tehnološkim uvjetima strojeva i opreme, današnja tehnologija omogućuje i preporuča dimenzije brazdi od 1-4 metra širine. Optimalna dimenzija se preporuča od 3 metra širine do 12 metara visine. Na taj način dobivamo veću tehnološku mogućnost dobivanja visoke kvalitete komposta i najbrže procese proizvodnje komposta. Nove razvijene tehnologije bioreaktorskog kompostiranja dovele su do većeg stupnja ekonomičnosti proizvodnje komposta te znatno manje prostora i vremena za proizvodnju eko komposta. Formiranje brazdi vrši se kombinirano, strojno i ručno, tako da se dobije jednolična dimenzija brazde. Slaganje brazdi prema strukturi otpada vrši se sljedećim redoslijedom. Podnožje formiranja brazdi radi se od najkrupnijih materijala iz zelenog otpada, granja, kore drveća i ostalog, dok se srednji sloj fomira iz biorazgradivog otpada iz domaćinstava, a na vrhu se formira najgušći dio organskog otpada, tako da kisik struji od dna brazed prema vrhu. Automatski strojevi za okretanje brazdi te dodavanje vode, bioaktivenata i kisika zahtijevaju formiranje brazdi tipskih dimenzija. Važno je tehnološki označiti širinu i količinu brazdi na betonskoj, nepropusnoj podlozi koja je dilatacijski izvedena.

BILJEŠKE

4. BIOREAKTORSKO OKRETANJE UZ DODAVANJE VODE, BIOAKTIVENATA I KISIKA

Specijalni strojevi za okretanje brazdi imaju više tehnoloških funkcija koje bitno doprinose proizvodnji kvalitetnog eko komposta. Današnja tehnologija okretanja omogućuje optimalno navlaživanje vodom koja je obogaćena specijalnim bioaktiventima, koje su uzgojene u laboratorijima specijalne namjene, za proizvodnju eko komposta iz pripremljenih materijala za biološku razgradnju. Kompostiranje u brazdama je najbrže i najekonomičnije.

Na strojevima za okretanje smješten je spremnik vode volumena 1000 litara. Unutar spremnika montirani su difuzori za obogaćivanje vode kisikom. U vodu se dodaju suhe bioaktiventi koje aeracijskim postupkom oživljavaju te se kroz dvije bočno smještene mlaznice dodaju kontrolirano u formirane brazde.

Prilikom okretanja brazdi dodajemo vodu, bioaktivente i kisik, što aktivno djeluje na brzi razvoj ciljanih bioloških reakcija na biomasu. Brzina okretanja bioreaktorskog stroja zavisna je od zadanih uvjeta tehnologijom okretanja kojom se moraju dobiti optimalni tehnološki uvjeti bioreaktorske razgradnje. Rotacijska cijev ima na sebi vijčane ozubljene spirale za unos zraka i formiranje brazdi.

BILJEŠKE

5. KONTROLA OPTIMALNE VLAŽNOSTI KOMPOSTA

Kontrola optimalne vlažnosti u proizvodnji komposta

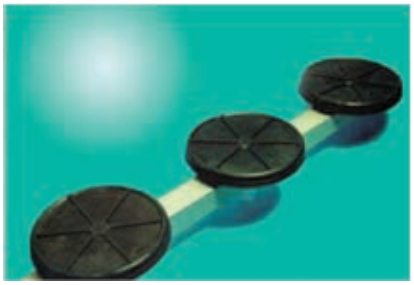
Priprema vode u aeracijskim bazenima oborinske vode

Kontroliranje temperature biološke reakcije komposta

Presuho

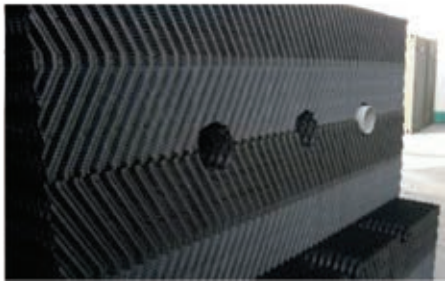
Premokro

Pravilna razina vlage



DIFUZOR

KONTROLA TEMPERATURE



UPOJNI BIOBOX

a) Kontrola vlažnosti komposta u brazdama je vrlo važan postupak nadzora i preporuke koja se mora ostvariti sa ciljem dobivanja optimalnih uvjeta biološke razgradnje kompostne mase u brazdama. Postoje tri nivoa vlažnosti; previsoki kada se zahvatom šake stisne zahvaćena biomasa, ona je gnjecasta i premokra, drži se u hrpi i cijedi voda. Drugi ekstremni slučaj presuhe biomase je kada se zahvatom šake sve rasipa i nema homogenizacije. Treći, optimalni način kontrole omogućuje optimalno vezivanje biomase. To je ujedno i pokazatelj optimalnog, kontroliranog procesa navlaživanja i proizvodnje komposta.

b) Priprema vode u aeracijskom bazenu je važan tehnološki proces. Sve oborinske krovne i površinske vode odlaze cijevnim sabirnim sustavom u sabirni bazen volumena od 30-200 m^3, zavisno od slivne površine. U tim bazenima postavljaju se 0,5 metara od dna gumeni aeratori za obogaćivanje vode kisikom te biološku pripremu uzgojenih bakterija. Aeracija se održava zračnim puhalima kroz difuzore u nakupljenoj vodi. Upravljački i kontrolni sustav nalazi se u nadzemnom kontejneru u koji je smješten sanitarni dio koji ulazi direktno u aeracijski bazen.

c) Kontrola temperature vrši se pomoću termometra na kojem je ugrađena sonda dužine 0,5 m, koja se ubada u formiranu kompostnu brazdu. To je optimalna temperatura na osnovu koje određujemo optimalni postupak daljnje tehnološke obrade biomase u brazdama. Za kvalitetu proizvodnje eko komposta treba formirati priručni laboratorij.

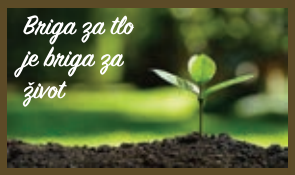
BILJEŠKE

6. PRIPREMA VODE U AERACIJSKIM BAZENIMA OBORINSKE VODE

PRIKAZ BAZENA ZA OBORINSKE KROVNE VODE

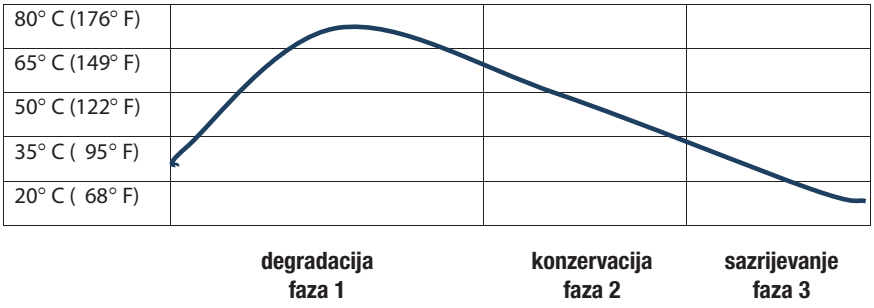
Postrojenje je opremljeno sa aeratorima - dozatorima zraka. U sustavu treba izvesti specijalni dozator bioaktivenata koje se aktiviraju u aerobnim bazenima. Potrebno je izraditi stambeni kontejner kao ured u kojim će se smjestiti oprema za pripremu vode kisikom za doziranje bioaktivenata. Specijalni kontejner mora imati specijalnu opremu, odgovarajuću električnu instalaciju, priključene cjevovode za klipne kompresore, cijevne instalacije te upravljački stol za pogon postrojenja. Kontejner mora biti izoliran, opremljen sa sustavom za boravak te elektronsku informatiku. Takav sustav je direktno povezan sa bazenom od 150 m^3, koji služi za prikupljanje krovnih i površinskih voda. Pumpe za punjenje kompostdera vodom imaju gumene cjevovode kojima se brzo dozira rezervoar od 1000 litara. Potrebno je aerobni bazen opremati sa preljevnim sustavom te sustavom za dopunjavanje vodom iz javnog sustava. Izgradnjom aerobnog sustava za pripremu oborinskih voda zaokružujemo novu tehnološku cjelinu koja omogućuje eko kompostiranje biorazgradivog i organskog otpada te se isti vraća u zelenu proizvodnju. Takvom kompletnom tehnologijom postižemo kružnu ekonomiju.

BILJEŠKE



7. KONTROLIRANJE TEMPERATURE BIOLOŠKE REAKCIJE KOMPOSTA

KONTROLA TEMPERATURE



Aktivnost organizama je osnova za pokretanje topline. Temperatura u tijelu brazde je najvažniji indikator u toku kompostiranja za napredak procesa raspadanja. Da bi se osigurao proces raspadanja, a posebno da se pravilno javlja sanacija, temperatura se mora mjeriti barem jednom na dan duž brazde i zabilježiti. Mjerenje je moguće raznim instrumentima (analognim, ručnim). Kako god, mjerna sonda treba se provući kroz jezgru brazde zbog unutarnjih različitih temperatura.

U raznim zemljama postoje različite regulative koje određuju mjerenja temperature (npr. Pravilnik o biootpadu), koji predviđa kontinuirana mjerenja u raznim dijelovima brazde sa odgovarajućim prijavama podataka i pohranom tih podataka na pet godina. Dodatak sadrži „Dnevnik kompostiranja“ u kojem se temperatura unosi u svrhe nadziranja. Ako se raspadanje pojavljuje korektno, krivulja temperature u kompostnoj brazdi i redovima slijedi karakterističnu krivulju.

Kontrola temperature vrši se pomoću termometra na kojem je ugrađena sonda dužine 0,5 m, koja se ubada u formiranu kompostnu brazdu. To je optimalna temperatura na osnovu koje određujemo optimalni postupak daljnje tehnološke obrade biomase u brazdama. Za kvalitetu proizvodnje eko komposta treba formirati priručni laboratorij.

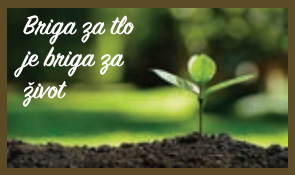
BILJEŠKE

8. PAKIRANJE OBOGAĆENOG KOMPOSTA PREMA POTREBI KORISNIKA

Proizvodnja kvalitetnog komposta u kontroliranim uvjetima je tehnološki postupak koji kontrolira i nadzire stručna osoba, imajući mjerne instrumente, kojima može kontrolirati postupak biološke razgradnje u kontroliranim uvjetima bez negativnog utjecaja na odvijanje procesa kompostiranja. Veliko iskustvo, znanje i upornost sigurno vode do uspjeha. Nemjerljiva je vrijednost dobivanja kvalitetnog eko komposta i njegovo korištenje u ciklusu kružne ekonomije, od odlaganja na deponije do načina kako sito radi.

U većini današnjih slučajeva dobiveni kompost može se obogatiti dodavanjem mineralnih gnojiva ili kvalitetnog humusa, što povećava njegovu vrijednost i postiže širinu primjene u poljoprivrednoj eko proizvodnji zdrave hrane za tržište, koja je obogaćena fosforom i drugim mineralima potrebnim u proizvodnji zdrave hrane. Optimalnost kapaciteta kompostane postiže se već od 10 000 ekvivalent stanovnika do 100 000 ekvivalent stanovnika. Veće kapacitete potrebno je uskladiti i optimizirati zelenu biomasu koja je znatno povećana u ljetnim uvjetima.

BILJEŠKE



POSTUPAK BIOREAKTORSKOG KOMPOSTIRANJA U KONTROLIRANIM UVJETIMA

KONTROLA OPTIMALNE VLAŽNOSTI U PROIZVODNJI KOMPOSTA
PRIPREMA VODE U AERACIJSKIM BAZENIMA OBORINSKE VODE
KONTROLIRANJE TEMPERATURE BIOLOŠKE REAKCIJE KOMPOSTA

Proces razgradnje - važni parametri za industrijsku proizvodnju eko komposta

Industrijsko kompostiranje je pod utjecajem brojnih važnih parametara tehnološkog procesa. Glavni parametri su opisani dolje sa njihovim utjecajem na proces kompostiranja i ponašanjem mikroorganizama. Da bi se postiglo brzo kompostiranje, moraju biti dostupni sljedeći uvjeti:

- Snabdijevanje hranjivim tvarima: glavne važne hranjive tvari su ugljik (C) i dušik (N), koji mora biti dostupan u dovoljnim količinama, u pravom omjeru i planiranom vremenu.
- Snabdijevanje kisikom: stalni dovod svježeg zraka u raspadni materijal je potrebna da se osigura dovoljno snabdijevanje kisikom, vodom i bakterijama.
- Temperatura: većina mikroorganizama aktivna u toku kompostiranja je termofilna (optimalna visina 50-65 °C) i mezofilna (25-45 °C). Intenzivni proces raspadanja pojavljuje se u termofilnom dometu, a sazrijeva u mezofilnom.
- pH vrijednost: većina mikroorganizama preferira pH neutralnu vrijednost.

Omjer ugljika-dušika

Omjer C/N opisuje volumen omjera ugljika prema dušiku u organskim spojevima. Niži omjer, bliži C/N omjer i nadalje dopušteno je više dušika. Omjer ugljika prema dušiku u ulaznom materijalu određuje brzinu i razvoj procesa raspadanja. Raspadanje organizama zahtijeva energetski bogate ugljične spojeve (C) da održavaju stabilni životni proces. Spojevi dušika (N) zahtijevaju da se izgrade proteini za rast i reprodukciju. Bez točnog omjera C/N u ulaznom materijalu, proces je usporen, a u ekstremnim slučajevima dolazi do zastoja.

Kao opće pravilo, zahtijeva se više ugljika nego dušika za brzo raspadanje i visoku kvalitetu komposta. Povoljan omjer C/N je u dometu od 30:1 (1 dio dušika prema 30 dijelova ugljika). Ako je omjer veći od 40:1, postoji nedostatak dušika i mikroorganizmi se ne mogu prikladno razvijati. To znači da je raspadanje sporo, rezultira nisko hranjivim kompostom. Ako je nedovoljno ugljika (omjer manji od 20:1), mikroorganizmi ne mogu formirati dovoljno tvari koje traže njihove stanice. Tada konzumiraju i vežu manje dušika. To znači da se dušik gubi i ispušta kao velika količina plina u atmosferu u obliku amonijaka (NH_3) (koji imat tipičan smrad) ili se može isprati kao nitrat (NO_3^-). Kada se planira brazda mora se uzeti u obzir omjer C/N u mješavini ulaznog materijala. To se kalkulira na bazi omjera C/N pojedinih tvari u odnosu na njihov podijeljeni volumen mješavine. Točna lista omjera C/N organskog materijala kao i njegov povoljan omjer miješanja je dana u dodatku.

BILJEŠKE

Nova tehnologija kompostiranja razvijena u kompaniji Tehnix omogućuje proizvodnju eko komposta u vremenu od 2 mjeseca. Doziranje bakterija, vode i zraka u natkrivenim kontroliranim uvjetima, omogućuje proizvodnju organskog gnojiva za proizvodnju zdrave hrane. Mikroorganizmi traže dovoljnu vlagu za njihov optimalni razvoj, jer se potrebni kisik apsorbira u tekućoj fazi. Prosječni sadržaj vode kompostnih brazdi treba biti između 40 i 50 % (postotak težine). Ako je sadržaj vlage prenizak, opskrba kisikom podbaci, kultura bakterija postaje neaktivna, a proces raspadanja je spor ili čak dolazi do zastoja. Ako je sadržaj vode previsok, kisik u zraku se potiskuje u šupljine i javlja se truljenje. Rezultat su neugodan miris i usporavanje procesa raspadanja. U praksi se pravilna razina vlage može odrediti testiranjem u šaci.

Presuho

Premokro

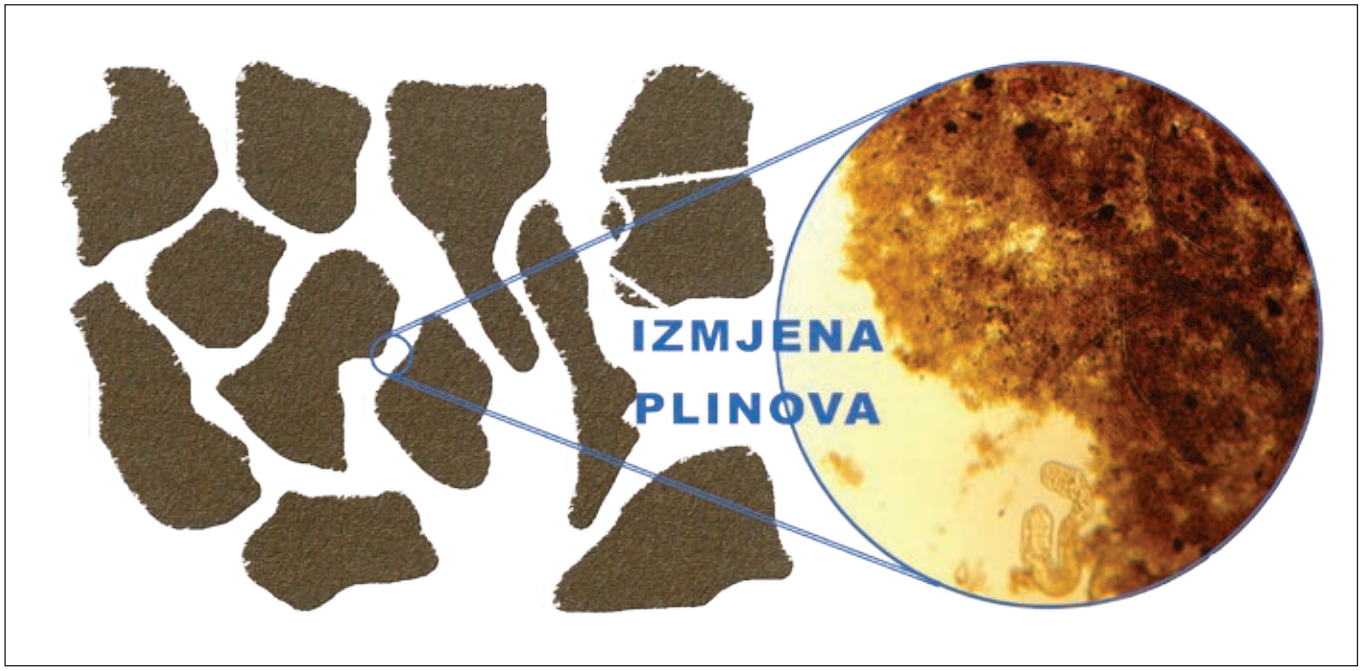
Pravilna razina vlage

Uzmite šaku materijala sa hrpe na dubini od barem 20 cm (oprez - materijal može biti vrlo vruć), i stisnite ga čvrsto u Vašoj šaci. Ako je materijal presuh, raspada se opet kada Vi otvorite šaku. Ako je materijal premokar, voda se cijedi kroz Vaše prste kada ga stisnete. Ako je sadržaj vlage idealan, uzorak ostaje u obliku stisnute loptice u Vašoj otvorenoj šaci. Materijal se osjeća kao isušena spužva.

Zahtjevi kisika

U praksi, kisik potreban za proces aerobnog raspadanja se dostavlja u kompostni materijal svježim zrakom (zrak iz prostora) koji obuhvaća oko 21% kisika. Metoda ubrizgavanja čistog kisika testirana u prošlosti nije se nastavila jer je preskupa. Mikroorganizmi odgovorni za proces raspadanja ne mogu međutim koristiti kisik direktno iz plinske faze svježeg zraka. Kisik sadržan u zraku mora najprije biti otopljen u tekućoj fazi i tada je dostupan mikroorganizmima. Zbog toga je sadržaj vlage brazdi važan. Ako ima dovoljno vlage u brazdama, krute čestice komposta su pokrivene vodenim filmom koji apsorbira dio kisika u zraku te je tada dostupan živućim mikroorganizmima na površini kompostnih čestica. Maksimalna sposobnost apsorpcije kisika tekuće faze određena je temperaturom sistema i opada sa povećanjem temperature brazde. U isto vrijeme povećavaju se zahtjevi za svježim zrakom.

BILJEŠKE



Prikaz čiste strukture i apsorpcije kisika *(izvor: radni priručnik kompostnog postrojenja)*

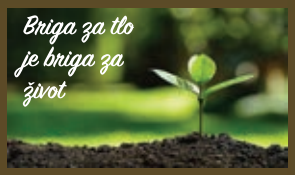
Zahtjevi svježeg zraka također ovise o sadržaju organskih tvari u tijelu kompostne brazde. Uzimajući u obzir temperaturu brazde i povezanu topljivost kisika, teoretski zahtjevi su od 1-2 litre kisika na kilogram organskog materijala, nadalje 4-8 litara zraka/kilogram organskog materijala na sat. Pretpostavljajući da je sadržaj organskog otpada u ulaznom materijalu cca 80 %, teoretski zahtjevi zraka svježe izgrađene brazde komposta sa gustoćom od 0,5 t/m^3 su od 1,6-3,2 m^3 svježeg zraka na m^3 kompostnog materijala.

U trokutastim brazdama takozvani dimni učinci rezultiraju stalnom zamjenom zraka u porama brazde. Topli zrak iz brazde izlazi na njezinom vrhu. Svježi zrak je izvučen na dno brazde sukcijom. To rezultira protokom svježeg zraka kroz brazdu što osigurava da je brazda dobro ventilirana, zavisno od materijala i veličine brazde.

U dodatku je također moguće promovirati dobavu svježeg zraka aktivnom aeracijom, koja je posebno potrebna u velikim brazdama i onima koje imaju male pore (nedovoljno glomaznog materijala ili previše vlage). U praksi, normalne stope odzračivanja su od 3-10 m^3 svježeg zraka po m^3 od kompostnog materijala na sat.

Dostupni su posebni instrumenti za određivanje sadržaja kisika u brazdama. Ako takvi mjerni instrumenti nisu dostupni, naše predviđanje je dobra zamjena za određivanje sadržaja kisika. Probajte miris šake raspadajućeg materijala. Ako miriše na zemlju, svježe i aromatično, to pokazuje da je dovoljno kisika, dok kiseli, jedak, truo miris pokazuje nedostatak kisika. Ako se veličina kompostne brazde smanjuje u roku nekoliko sati i ruši, to također može ukazivati na nedostatak kisika. Uz industrijsko kompostiranje potrebno je osigurati laboratorij, opremljen mjernim instrumentima za praćenje tehnološkog procesa. Važno je osigurati dobre prostorne uvjete i dobru pripremu biomase.

BILJEŠKE



Volumen pora

Kao što je opisano gore, i zrak i voda potrebni su da se dovede kisik do mikroorganizama. Oboje se natječu jedan sa drugim, jer koriste pore (šupljine) između čestica kompostne brazde. Volumen pora kompostne brazde ovisi o dotičnom ulaznom materijalu. Iz tog razloga je potrebno da je organski materijal predobrađen (sjeckanje, miksanje) na početku procesa kompostiranja da utječe na volumen pora i kao rezultat sadrži kisik i vodu.

Dovoljna dobava kisika je jedino garantirana, ako je volumen pora adekvatan u brazdi, koja osigurava da su sve čestice dovoljno pokrivene vodom i da postoji slobodan i adekvatan protok zraka. To se garantira količinom glomaznog materijala u tijelu brazde, njegov sastav je labav na početku procesa raspadanja i redovnim okretanjem.

Potrebno je okrenuti brazde da se nadoknadi zbijeno statičko tijelo brazde zbog svoje težine. Učinak popuštanja i miješanja je odlučujući, jer je zanemariv učinak potpune zamjene pora zraka zbog okretanja. Praktična mjerenja su pokazala da sadržaj kisika u zraku pora u svježem kompostu pada na oko 0 posto u roku od 60 minuta, ali se diže u sljedećim satima na razinu od oko 15-20 posto. Taj fenomen se može objasniti činjenicom da je efekt dimnog učinka u toku okretanja brazde uništen potpunim preuređenjem svih čestica u tijelu brazde, no ponovno se vraća kada je volumen pora zadovoljavajući.

Temperatura

Aktivnost organizama je osnova za pokretanje topline. Temperatura u tijelu brazde je najvažniji indikator u toku kompostiranja za napredak procesa raspadanja. Da bi se osigurao proces raspadanja, a posebno da se pravilno javlja sanacija, temperatura se mora mjeriti barem jednom na dan duž brazde i zabilježiti. Mjerenje je moguće raznim instrumentima (analognim, ručnim). Kako god, mjerna sonda treba se provući kroz jezgru brazde zbog unutarnjih različitih temperatura.

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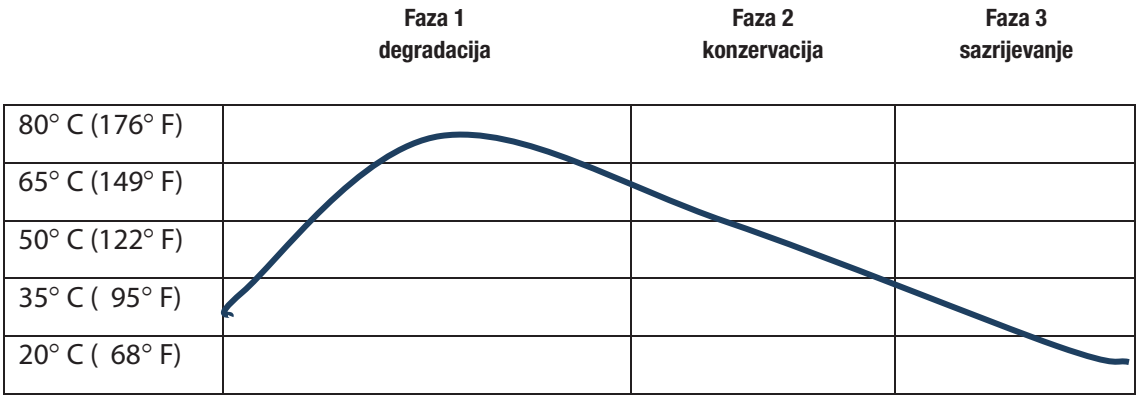
BILJEŠKE

Ako se raspadanje pojavljuje korektno, krivulja temperature u kompostnoj brazdi i redovima slijedi karakterističnu krivulju.



Krivulja temperature kompostne brazde u toku kompostiranja

Faza 1: faza raspada/tjedan kompostiranja 1-4/T = 55-70 °C

Toplina je generirana metaboličkim aktivnostima mikroorganizama sadržanih u raspadajućem materijalu. Tamo je više termofilnih mikroorganizama i oni su višestruko eksplozivni. U toj fazi kompostni materijal je dezinficiran. Većina donesenih sjemenki ostaje sterilna. Štetočine su ubijene. Prvo se rastvaraju topljivi spojevi poput aminokiselina i topljivih proteina, šećer i masne kiseline. Na kraju faze raspadanja, raspadnuti materijal se rastvara do njegovih sastavnih dijelova tako da termofilni mikroorganizmi mogu zatvoriti njihove aktivnosti i izumrijeti. Oni služe kao hranjiva tvar za druge mikroorganizme i gljivice. Temperatura pada. Raspadni materijal se promijenio u smeđi ili crno-smeđi, sočno zelena sirovina nije više prepoznatljiva.

Faza 2: faza konverzije / tjedan kompostiranja 4-8/T = 35-55 °C

Posljedični radovi konverzije se sporije odvijaju. Osim bakterija, gljivice (mezofilna miješana flora) je također aktivnija. Postala je specijalizirana u raspadanju tvari koje se teško rastvaraju poput celuloze i lignina (drva). Kasnije su posebno važne za formiranje humusa. Na kraju faze konverzije temperatura se postavlja na 30-40 °C.

Faza 3: Rekonstitucija i faza sazrijevanja / od 8. tjedna kompostiranja / T < 35 °C

Počinje formiranje humozne tvari. Osim mikroorganizama, brojni mali organizmi poput grinja, skokuna i nematoda upadaju (najezđuju se) u raspadni materijal. Oni ograničavaju rast gljivica. Kompostni crvi kombiniraju mineralnu i organsku frakciju i proizvode tzv. složeni glineni kompost. Zreli kompost može se prepoznati po njegovoj boji, humozna tvar daje mu tamno smeđu boju. Labava i mrvljiva struktura pokazuje da je proces raspadanja završio. Da bi se osiguralo javljane procesa raspadanja, a posebno dezinfekcije, temperatura se mora mjeriti najmanje jednom na dan kroz brazdu i bilježiti.

BILJEŠKE

Vrijednost pH

Aktivnost mikroorganizama te time i gustoća procesa raspadanja također utječu na pH vrijednost kompostiranog materijala. pH vrijednost u lužičnom dometu do 11 nema negativni efekt na napredak procesa raspadanja, ali pH vrijednost znatno ispod 7 u kompostiranom materijalu usporava mikrobnu aktivnost, posebno na početku procesa raspadanja. Mikrobna faza, u kojoj se jedva može zabilježiti bilo kakav rast jer se bakterije moraju prilagoditi njihovom novom okruženju, a njihova metabolička aktivnost je stavljena na podjelu, povećava se eksponencijalno sa povećanjem pH vrijednosti. Na pH vrijednosti ispod pet, znatno je ograničavajući primijećeni učinak.

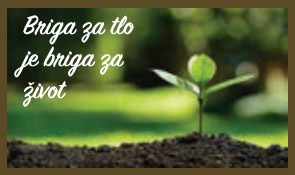
pH vrijednost treba se mjeriti u prvom tjednu kompostiranja i na kraju procesa kompostiranja. U slučaju poremećaja u procesu raspadanja, mjerenje pH vrijednosti se preporuča da se locira razlog. pH vrijednost je mjerena elektrodom ili manje često sa trakama lakmus papira koji mijenja boju zavisno o pH vrijednosti. Elektrode i lakmus papir su prikazane u dodatku.

Stupanj raspadanja ili zrelosti

Stupanj raspadanja ili zrelosti se koristi da se procijeni napredak procesa raspadanja i biološka stabilnost komposta. Stupanj raspadanja može se determinirati jednostavnim samozagrijavajućim testom koji može potrajati i nekoliko dana. Kao rezultat testa, kompost se ocjenjuje kao svježi ili gotovi kompost. Svježi kompost je dezinficiran, raspadni materijal se trenutno intenzivno raspada ili raspadni materijal koji je ima sposobnost intenzivne razgradnje. Gotov kompost je dezinficiran, biološki stabiliziran kompost.

Druga jednostavna, ali mnogo brža metoda je određivanje zrelosti sredstvom SOLVITA. Rezultati su dostupni nakon četiri sata te osim informacije o biološkoj stabilnosti daje i informaciju o mogućim greškama u procesu raspadanja. Za daljnje informacije vidite www.solvita.com.

BILJEŠKE



Načela procesa kompostiranja

Priprema materijala

Materijal isporučen na područje kompostiranja je normalno u stanju koje nije prikladno za neposredno kompostiranje. Granje i žbunje, grmlje, reznice drveća, drvo od panjeva i debala kao i trava, sijeno i lišće moraju se usitniti i nasjeckati prije stvaranja kompostne brazde da se osigura optimum procesa raspadanja.

Na tržištu su dostupni mnogi strojevi za taj posao. U načelu su dva tipa: brzoradni strojevi (čekić drobilica, čekić mlin, rezni mlin ...), također nazvane sjeckalice ili drobilice te spororadni strojevi (jednovaljčane ili dvovaljčane drobilice, pužni mlinovi...), također nazvani kidalice.

Normalno se materijal propušta kroz integrirano sito kada se ispušta iz stroja, tako da proizvod sadrži čestice definirane veličine. Taj raspon je od 50-150 mm. Općenito je materijal vrlo fibrozan (vlaknast) te ima brojne svježe lomljene površine na koje se lako mogu smjestiti mikroorganizmi. Što je materijal jednoličnije usitnjen, to je proizvodnja eko komposta ujednačenija, vremenski kraća i kvalitetnija.

Kontroliranje procesa raspadanja u kontroliranim brazdama formiranim prema kapacitetu tehnoloških uvjeta

Kisik

Sistem kompostne brazde koja nije prožeta ugljičnim dioksidom mora osigurati da se svježi zrak može raspršiti u središtu brazde između operacija okretanja. U brazdama koje nisu prožete ugljičnim dioksidom je vrlo važno, zbog tog razloga, obratiti pažnju na ispravan omjer između presjeka brazde, mješavine materijala (posebno volumena zračnih pora, temperature ili kisikom kontrolirane aeracije ...) da se osigura da aerobni proces bude aktivan u brazdama.

Dovoljno snabdijevanje kisikom može također biti optimizirano sredstvima dodatnog aeracijskog sistema u dodatku sa redovnim okretanjem brazdi. Umjetno prozračivanja kompostnih brazdi, dopušta veće brazde i time manje zahtjeve prostora. Postoje različite metode moguće aeracije (npr. pozitivni ili negativni aeracijski pritisak, aeracija kontrolirana temperaturom ili kisikom, ...) da se osigura aktivan aerobni proces u brazdama.

BILJEŠKE

Vlaga

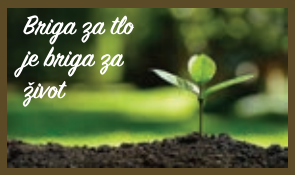
Zalijevanje brazdi osigurava da se održava optimalna razina vlage u brazdama za najbolji proces raspadanja. Zalijevanje je moguće ili ručno ili direktno kod okretanja, koja je kasnije najbolja metoda, jer se dodana vlaga i bakterije distribuiraju čak kroz brazdu u toku okretanja. Optimalna dimenzija brazdi je širina 3 metra, visina 1,5 metar.

Okretanje - zašto je okretanje potrebno?

U toku procesa raspadanja omjer zraka-vode-zemlje kompostne brazde se mijenja zbog mikrobnog raspadanja i prirodno postavljenih učinaka. Javljaju se lokalne promjene u strukturi i raspodjela vlage u kompostnoj brazdi. Zbog težine mase materijala iznad njega, donji sloj brazde je zbijen. Višak vlage se skuplja na dnu brazde. Da bi se osigurali redovni i homogeni uvjeti za raspadanje cijele brazde, potrebno je i važno redovno okretanje.

Kao rezultat okretanja, materijal se olabavljuje, dopušta prodiranje kisika. Mikrobna aktivnost je još jednom stimulirana, što rezultira povećanjem temperature. Zbog prodora novog kisika u brazdu, sprečavaju se anaerobne zone i anaerobni procesi te smrad. U toku okretanja, suhe i vlažne zone brazde su pomiješane, a razina vlage je izravnana.

BILJEŠKE



Redovno okretanje u fazi intenzivnog raspadanja osigurava, da kada su pomiješane jezgra i vanjske zone, sve čestice brazde budu u centru na dovoljno dugi period, a visoke temperature garantiraju dezinfekciju kompostnog materijala, tako da se klice i sjeme divljih biljaka pouzdano uništavaju.

Okretanje također osigurava viši stupanj homogenosti i kvalitete komposta sa ponavljanim miješanjem i redovitim raspadanjem. Zbog ove homogenosti materijala, količina materijala zadržanog u toku prosijavanja se reducira, a količina komposta povećava.

Koliko često se mora okretati brazda?

Okretanje se može regulirati vremenom i procesom raspadanja te stupnjem taloženja (sabijanja) brazde. Rahlost organske mase doprinosi kvaliteti kompostiranja. Tokom raspadanja organske tvari se mineraliziraju. U isto vrijeme volumen i masa brazde se smanjuju.

Praktična veličina i volumen pora se smanjuju, što u okretu znači manji protok svježeg zraka kroz brazdu. Smanjenje volumena pora rezultira iz taloženja brazde, ima negativan utjecaj na živući okoliš aerobnih mikroorganizama i ograničava njihovu aktivnost. Nakon zastoja temperatura brazde opada. Brazda se mora okretati najkasnije kada temperatura padne do 5 °C u roku 24 sata. Tehnologija kompostiranja mijenja se po godišnjem dobu.

Bezbroj puta se brazda okreće zavisno o vrsti kompostiranog materijala, njegove strukturne stabilnosti, odabrane veličine brazde, ponašanja taloženja brazde i stanju raspadanja. Kao vodič za okretaje uzima se u obzir sljedeće:

- Intenzivno raspadanje:	okretanje 3-4 puta tjedno
- Sazrijevanje:	okretanje 2-3 puta tjedno

Rafiniranje

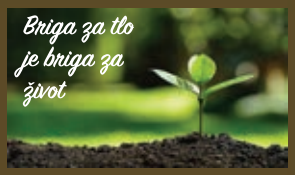
Prosijavanje i probiranje je potrebno da se rafinira gotov kompost ili zemlja i substrati proizvedeni iz komposta i drugih agregata.

Prosijavanje

Prirodno su kompost i zemlja dostupni u sljedećim dimenzijama čestica:

- Svježi kompost kao poljoprivredno gnojivo	0/40 mm
- Gotov kompost za miješanje za vrtlarenje i uređenje	0/20 mm
- Gotov kompost kao gnojivo za privatne vrtove	0/10 mm
- Gotov kompost za povrtnu zemlju (rahli i pakiran)	0/10 mm
- Kompost za rekultivaciju	0/40 mm

BILJEŠKE



U osnovi proizvedeni kompost nije spreman za prodaju odmah nakon raspadanja, nego se mora prosijati (probrati) da se dobiju tražene veličine čestica u serijama kao što je traženo ili prema specifikaciji kupca. Postoje razni strojevi za prosijavanje i probiranje na tržištu. Sljedeći popis pokazuje strojeve za prosijavanje koji se koriste za prosijavanje komposta i njihova primjena:

Odvajanje kontaminata

Odvajanje zraka

Odvajanje zraka, također nazvano kao zračno-protočno odvajanje, je mehanički proces za sortiranje sa odabranim protokom zraka. Sortirani materijal je odvojen u dvije ili više frakcija zavisno o obliku i veličini pojedinih čestica. Zračni odvajači su klasificirani zavisno o smjeru protoka zraka u tri grupe - poprečno protočni odvajači (zrak protječe preko protoka materijala), protusmjerni odvajači (zrak protječe suprotno od protoka materijala) i cik-cak odvajači (zrak prolazi preko smjera protoka nekoliko puta). Poprečno protočni odvajači su postali najkorišteniji za kompostiranje.

Zračni odvajači mogu se koristiti kod dvije točke procesa kompostiranja:

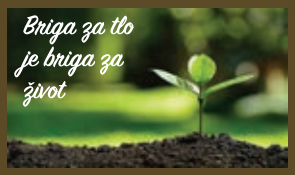
1. Kada se priprema ulazni materijal prije kompostiranja i raspadanja za otklanjanje laganih materijala poput filma (tanka prevlaka) i plastičnih vreća.
2. Kada se rafinira gotov kompost za otklanjanje filma ostataka od prevelikih čestica koje su ostale u toku konačne faze prosijavanja, tako da su čiste te se vraćaju u proces kompostiranja nakon drobljenja u roto drobilici.

Zračni odvajači su dostupni kao stacionarni i mobilni uređaji te se obično koriste za konačno prosijavanje gotovog komposta direktno nakon što stroj za prosijavanje otkloni grube čestice.

Magnetski separator

Metalne čestice se otklanjaju u kompostnim radovima magnetskim separatorom koji odstranjuje željezo i metalne ostatke iz protoka materijala pomoću električnog ili permanentnim magnetom. Mnogi mobilni uređaji (drobilice, sjeckalice, strojevi za prosijavanje...) imaju takav separator u obliku magnetskog bubnja na izlaznoj točki transportnog remena ili nadzemni magnet na remenastoj opremi. Idealna točka magnetskog odvajanja je na izlaznim odjeljcima na kraju remenaste trake, jer cijeli materijal teče pored magneta i ovdje se metalne čestice najbolje mogu izvaditi iz protoka materijala.

BILJEŠKE



Odvajači kamenja i stakla

Odvajači čvrstog materijala su potrebni da se otkloni kamenje i staklo iz komposta. Oni koriste razliku u elastičnosti i utjecaj svojstava tvrdih materijala u odnosu na mekše čestice komposta. Kompost je usmjeren u specijalne separacijske bubnjeve, a različite odbojne karakteristike materijala rezultiraju iz njihove elastičnosti te se utjecaj ponašanja koristi da se odvoji materijal. U nekoliko slučajeva koriste se pneumatski koncentratori (također se odnose na odvajanje pločica ili „zračnih jata“) za separaciju stakla i kamenja. Separacija se izvodi u skladu sa gustoćom čestica i izloženosti protoku zraka iz ravnog poklopca sita. Postoji nekoliko uređaja i nekoliko strojeva za prosijavanje ili zračni separatori da se otkloni kamenje iz prevelikih čestica u zadnjem postupku prosijavanja. Okrugle čestice (kamenje, šljunak...) se odvajaju brzohodnim trakama sredstvima sa valjkastim svojstvima.

Kompostiranje praktičnom brazdom

Rad sa brazdama je najbolji način proizvodnje eko komposta. Rad u postrojenju za kompostiranje je okarakteriziran sa nekoliko redovnih poslova. Sav ulazni materijal mora biti kontroliran i pripremljen za formiranje brazdi, dimenzija prema kapacitetu strojeva.

Dostava materijala i odstranjivanje kontaminata

Organski otpad, zeleni otpad i drugi materijali pregledavaju se kod dobave. Serije koje nisu prikladne za kompostiranje jer sadrže visoku razinu kontaminata, neće se prihvatiti i moraju se odbiti. Sve ostale serije se važu i dokumentiraju u radnu knjigu upisa sa njihovim tipom, količinom i porijeklom. Nakon vaganja i upisa, prihvaćeni materijal se istovaruje sa kamiona i ponovno pregledava.

Istovarivanje i raspršivanje dobavljenog materijala na ravnu površinu dokazalo se efikasnim u praksi. Kontaminati se mogu odmah ukloniti rukom. Da se olakša odstranjivanje kontaminata, organski otpad se tada može separirati prosijavanjem sa mrežom od 20 ili 50 mm u grubu i finu frakciju. Metalne čestice u frakciji se mogu odstraniti magnetskim separatorom sadržanim na ispusnoj traci. Gruba frakcija se oslobađa od ostalih kontaminata (plastični film, kamenje) ili rukom ili mehanički, te se dodaje u kompost kao glomazni materijal ili se prodaje kao kruto organsko gorivo u sastavu RDF goriva.

Usitnjavanje i homogenizacija

Sirovi kompostni materijal se usitnjava ili sjecka da se optimizira proces raspadanja. Glomazni otpad poput reznica, granja i korijenja mora se usitniti ili nasjeckati kada je dostavljen. Sjeckalica osigurava da se drvena vlakna otvore i osiguraju povoljnu površinu za nastanjenje mikroorganizama i vlažnosti. To je naročito važno kod bioreaktorskog kompostiranja, jer se na takav tehnološki najbolji način dodavanja vode obogaćene uzgojenim bakterijama te kisikom, omogućuje najkvalitetniji način biološke aktivnosti za jednomjerno kompostiranje.

BILJEŠKE

Kada se kompostira nisko opsežan organski otpad, mora se dodati glomazni otpad (sjeckano ili usitnjeno drvo i reznice grmlja) da se osigura da kompostna brazda ima dovoljan volumen zračnih pora. Materijal prosijan od gotovih proizvoda je povoljan kao glomazni materijal, ako razina kontaminata nije previsoka.

Organski otpad, otpad iz trgovina i kanalizacijski mulj moraju se obraditi posebno brzo jer inače proizvode nepodnošljive mirise. Mješavina tih nisko strukturiranih materijala sa prikladnim glomaznim materijalom je moguća na nekoliko načina. Osim specijalno ojačanih miješalica koje normalno rade u gomilastom načinu, okretači trokutastih brazdi su vrlo prikladni kao miješalice.

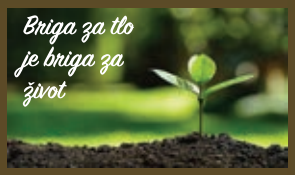
Intenzivno raspadanje (početno kompostiranje/vruće kompostiranje)

Intenzivno raspadanje ili faza početnog/vrućeg kompostiranja je prva faza kompostiranja. Karakteristična je po visokim temperaturama i visokim stupnjem raspadanja lako razgradljivih organskih tvari. Zbog te svojstvene topline izazvane u materijalu, on je dezinficiran, a patogeni su uništeni. Da bi se osigurao optimalni početak intenzivnog raspadanja, potrebno je obratiti pažnju na konstrukciju kompostne brazde, jer greške u toj fazi mogu negativno utjecati na cijeli proces kompostiranja, a mogu se ispraviti velikim naporom kada počne proces raspadanja. Idealna dimenzija brazdi je, širina 3 m, visina 1,5 m.

Ako je kombiniran kompostni materijal različite vlažnosti, brazda se mora napraviti horizontalno, sa suhim materijalom na dnu, a vlažnim (poput kanalizacijskog mulja) na sloju iznad. U isto vrijeme moraju biti osigurane optimalna širina i težina brazde za efikasno okretanje i navlaživanje sa bakterijama

Kompost u intenzivnoj fazi raspadanja

BILJEŠKE



Različiti materijali su intenzivno miješani kada se brazda okrene, što je potrebno što prije kad je brazda izgrađena. Rezultati miješanja moraju se pregledati odmah i mogu se poboljšati čestim okretanjem, ako je potrebno. Ako su brazda i mješavina optimalno planirane i primijenjene, javlja se znatan porast temperature u brazdi nakon samo nekoliko sati. Ako temperatura ne poraste, napravljene su greške u toku izgradnje brazde. Sastav, razina vlage i struktura brazde moraju se provjeriti i ispraviti, ako je potrebno.

Temperatura > 55 °C je potrebna u brazdi u vremenu od 2 tjedna za pouzdanu dezinfekciju, a brazda se mora okrenuti nekoliko puta da se osigura da je cijeli materijal bio u jezgri brazde u prikladnom periodu. Brazda se mora okrenuti barem 8 puta, što znači najmanje 1 put tjedno.

Nakon početka procesa dezinfekcije, ne smije se dodavati svježi materijal na brazdu da se spriječi ponovna infekcija. Mora se mjeriti temperatura brazde i dnevno bilježiti kako bi se osigurala evidencija dezinfekcije. Temperatura > 75 °C mora se izbjeći jer će doći do zastoja procesa raspadanja. Vlažnost brazde mora se redovito provjeravati, barem jedanput tjedno. Ako je potrebno brazda se mora redovito okretati i vlažiti.

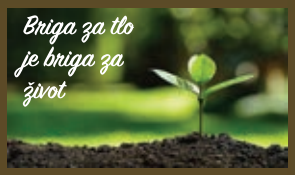
Sazrijevanje

Faza sazrijevanja je faza u toku koje se biološke aktivnosti usporavaju u brazdi, a temperatura pada ispod 55 °C. Kompost se tada odnosi kao svježi kompost. Ako je proces raspadanja pravilno kontroliran, faza sazrijevanja počinje oko dva-četiri tjedna nakon dezinfekcije. Faza sazrijevanja služi da se kompost biološki stabilizira i smanji emisija smrada, koja je još uvijek moguća kod svježeg komposta. Proces raspadanja je nadziran redovnim mjerenjima temperature i provjerom vlažnosti te također provjerom stupnja raspadanja na kraju procesa. Kompostna brazda se tada okreće i vlaži, ako je potrebno. Faza sazrijevanja počinje kada se svježi kompost pretvara u biološki stabilan gotov kompost, a temperatura brazde opada ispod 45 °C. To je normalno 6-12 tjedana nakon početka intenzivne faze raspadanja. Obično više nije potrebno okretati gotov kompost. Gotov kompost se tada sortira postupkom prosijavanja i usitnjavanja preostalih krupnih dijelova.

Rafiniranje (fina obrada)

Rafiniranje, također nazvano klasifikacija, služi da se proizvede konačni proizvod i odstrane kontaminati. Tehnički, rafiniranje se izvodi prosijavanjem. Zavisno o traženim veličinama čestica konačnog proizvoda, koriste se finokalibarska sita (do 12 mm), srednjekalibarska sita (do 25 mm) ili velikokalibarska sita (do 40 mm). Materijal koji ostane nakon prosijavanja može se općenito ponovno iskoristiti za kompostiranje glomaznog materijala.

BILJEŠKE



Zračni odvajači mogu se koristiti u toku rafiniranja gotovih proizvoda za smanjenje kontaminacije sa laganim materijalima (komadići filma). Nadalje, može se koristiti odvajač krutog materijala (ako se traži) za obojene metale ili valjkasti separator za neželjezne materijale. Gotovi proizvodi moraju se zaštititi od kiše i ustajale vode. Proizvodi su također zaštićeni od vjetrom prenosivih sjemenki kada je pokriven membranom ili folijom.

Optimiziranje procesa kompostiranja

Ako proces raspadanja ne napreduje prema željenom, rješenje je uvijek okretanje brazde. Prikazana je lista glavnih smetnji procesa kompostiranja sa odgovarajućim korektivnim mjerama:

Ne pregrijati svježe sastavljene brazde komposta (T<50 °C)

Razlog:
1. Nedovoljno vlage
2. Omjer C/N je previsok, nedostatak dušika
3. Sirovi kompostni materijal nedovoljno izmiješan ili usitnjen
4. Niska pH vrijednost
5. Temperatura zraka preniska

Korektivna mjera:
1. Okrenuti i navlažiti
2. Dodati dušik agregat i okrenuti
3. Okrenuti nekoliko puta, ako je potrebno usitniti ponovno materijal
4. Dodati kalcijev karbonat ($CaCO_3$) i okrenuti
5. Povećati volumen brazde, dodati svježi kompost

Brazde komposta postale prevruće (T>75 °C)

Razlog:
1. Omjer C/N je prenizak, previše dušika
2. Akumulirana vrućina u brazdi

Korektivna mjera:
1. Dodati drveni materijal (reznice, slama...), često okretati i vlažiti
2. Okretati nekoliko puta, vlažiti ako je potrebno

Intenzivni smrad amonijaka na početku faze intenzivnog raspadanja

Zapažanja: Može se otkriti jedak, oštar smrad amonijaka (NH_3). Ako je para jaka, mogu peći oči.

Razlog:
1. Previše dušika (omjer C/N ispod 20:1)
2. pH vrijednost previsoka

Korektivna mjera:
1. Dodati visoko ugljične materijale, npr. piljevinu ili slamu
2. Snižavati pH vrijednost dodavanjem kiselih tvari ili izbjeći bilo kakve alkalne tvari poput vapna i drvenog pepela u brazdi.

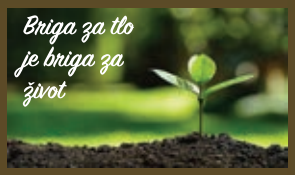
Kompost je presuhi

Zapažanja: Manje para ispušteno iz brazdi. Prašina se ispušta kod okretanja.

Razlog: Previše vlage je ishlapilo zbog efekata vrućine, sunca ili vjetra.

Korektivna mjera: Okretati i vlažiti materijal

BILJEŠKE



Kompost je premokri

Zapažanja:	Kompost je ljepljiv i umašćen te neugodno smrdi. Kada se stisne u šaci iz njega curi voda.
Razlog:	1. Natopljenost kod jakih kiša 2. Prečesto i intenzivno vlaženje brazdi 3. Nepravilna mješavina na početku procesa raspadanja
Korektivna mjera:	1. Okretati nekoliko puta kada kiša prestane 2. Prestati vlažiti, često okretati 3. Dodati suhi materijal (npr. slamu)

Pojavio se neugodan miris

Zapažanja:	Primjećuje se truli miris
Razlog:	1. Nedovoljno aeracije ili ventilacije 2. Previše vlaženja brazde 3. Nastanak anaerobnog procesa, nastaje plin
Korektivna mjera:	1. Okretati brazdu i dodati suhe tvari 2. Dodati glomazni materijal (npr. slamu) 3. Pokriti brazdu u toku teških kiša (npr. sa membranom)

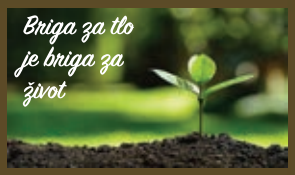
Zakašnjelo raspadanje

Zapažanja:	Temperatura se ne diže nakon okretanja (T<50 °C). Boja komposta se ne mijenja.
Razlog:	1. Nepovoljni uvjeti kompostiranja 2. Organski materijal se uglavnom raspao
Korektivna mjera:	1. Provjeriti i ispraviti parametre (vlaga, pH vrijednost...) 2. Inicirati fazu sazrijevanja

Kvaliteta komposta i korištenje

Kada je raspadanje gotovo, kompost je slobodan od plodnih sjemenki i biljnih ostataka. To se postiglo dezinfekcijom, koja je nadzirana redovitom provjerom temperature. Kompost mora također biti slobodan od kontaminata. Neželjeni ostaci poput komada stakla, metala, velikog kamenja itd. moraju se skupiti sa podloge, ili prije ili nakon što je raspadanje gotovo. Kompost treba biti homogene kvalitete i imati uravnotežen omjer hranjivih tvari. Sadržaj vode do 45% težine očekuje se za rahljenje proizvoda, a maksimalni postotak težine od 35 za materijal u vrećama. Kompost u svojoj kvaliteti mora biti dobar, tako da se može prodati sa dobrom sviješću obogaćivanja tla.

BILJEŠKE



Kompost je organsko gnojivo sa niskim do srednjim količinama fosfora, kalija, dušika, vapna, raznim elementima u tragovima i visokim sadržajem relativno stabilnih organskih tvari (humusa). U poljoprivrednoj primjeni kompost može potpuno pokriti osnovno snabdijevanje fosforom, kalijem i vapnom tako da je potrebno samo dodatno gnojenje sa dušikom. Kompost je tako zanimljiva zamjena za sve skuplja mineralna gnojiva za konvencionalnu poljoprivredu te se također nabavlja od vlasnika organskih farmi. Normalan raspon količina je od 10-20 t/ha u tri godine.

Fizički i biološki efekt komposta na zemlju ima dodatnu prednost u poljoprivrednoj praksi. Kompost ima pozitivan utjecaj na zdravlje biljaka i povećava njihovu otpornost na štetnike i druge negativne prirodne učinke. Kompost poboljšava apsorpciju vode i kapacitet skladištenja zemlje te poboljšava njegovu obradivost i trgovanje. Osim toga kompost ima pozitivan učinak na organizme u tlu i minimalizira osjetljivost zemlje na eroziju, zbog njegovih pozitivnih karakteristika, kompost se također koristi za vrtove i vrtne krajolike, rekultivaciju, šumarstvo, bašte, vrtne centre kao i za parkove.

Uzorkovanje

Reprezentativni uzorak mora biti uzet iz komposta za laboratorijsku analizu dotičnih parametara. Za tu svrhu uzeti su individualni primjerci na različitim mjestima u brazdi koji se tada kombiniraju u jedan uzorak. Grublji materijal, moraju se uzeti individualni primjerci da se osigura reprezentativni uzorak. Ako je veličina čestica manja od 20 mm, individualni uzorak je potreban za svakih 10 tona, ako je veličina čestica viša od 20 mm, traži se jedan primjerak za svakih 5 tona komposta. Količina materijala za svaki primjerak zavisi o maksimalnoj veličini čestica (d) analiziranog materijala, a može se izračunati prema sljedećoj formuli:

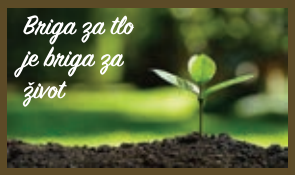
$$G\ (kg) = 0{,}06 \times d\ (mm)$$

Minimalna količina za individualni uzorak je tada 0,6 kg za čestice veličine od 0/10.

Važno je napomenuti da se proizvedeni kompost može obogaćivati dodatnim mineralnim gnojivima, kvalitetnom zemljom i humusom. Najbolje je izvršiti stručne konzultacije sa korisnicima kompostnog gnojiva koji nas mogu usmjeriti na vrstu proizvodnje u poljoprivredi te planirane usjeve u godišnjem proizvodnom ciklusu.

Zdrava hrana je najbolji lijek za dugi život čovjeka.
Tehnix je Vaš partner u proizvodnji eko komposta!

KOMPANIJA TEHNIX ZADRŽAVA PRAVO IZMJENA I DOPUNA TEKSTA KATALOGA



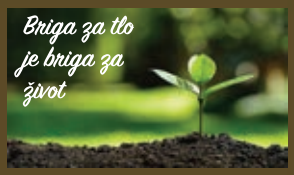
MO-BO-TO JE INOVATIVNA TEHNOLOGIJA ZA POTPUNU RECIKLAŽU KOMUNALNOG OTPADA

Kompanija TEHNIX vodeća je inovativna eko industrija u svijetu. Razvili smo reciklažni sustav MO-BO-TO za koji ne treba deponija. To su suvremene tipske tvornice za potpunu industrijsku reciklažu prikupljenog i dopremljenog predsortiranog ili miješanog komunalnog otpada. Dnevni kapaciteti MO-BO-TO tvornica određuju se prema broju stanovnika u gradu, općini ili zajedničkim korisnicima sa izračunom 1 stanovnik / 1 kg/dan, što znači da 25 tisuća stanovnika proizvodi približno 25 tona miješanog komunalnog otpada po danu, tada trebamo postrojenje od 2,5 t/h ili grad od 50 000 stanovnika treba postrojenje od 5 t/h ili grad od 100 000 stanovnika treba postrojenje od 10 t/h, ili grad od 200 000 stanovnika treba postrojenje od 20 t/h, ili grad od 400 000 stanovnika treba postrojenje 2 x 20 t/h.

MO-BO-TO tvornice grade se kao montažne čelične hale koje se mogu nadograđivati, seliti zavisno od raspolaganja prostorom. Kompanija Tehnix preko 20 godina ulagala je u sustav razvoja MO-BO-TO tehnologije na kojoj dopremljeni komunalni otpad recikliramo 100% u istom danu kada je dopremljen na reciklažu. Veliki inovativni kapacitet stručnjaka, inženjera, suradnika omogućio je razvoj i tehnološko otkriće najbolje reciklažne industrije kojom komunalni otpad recikliramo prema materijalnim i energetskim vrijednostima te ponovno vraćamo na uporabu u industriju. Na taj način postižemo kružnu ekonomiju i održivi razvoj planete Zemlje.

MO-BO-TO tehnologija je tehnološko otkriće kompanije Tehnix. Korištenjem TEHNIX-ove MO-BO-TO tehnologije postižemo reciklažu na postrojenju sortiranja i dobivamo 8 vrsta čistih baliranih sirovina. Izdvajanjem biorazgradivog otpada proizvodimo kompost i organsko gnojivo. Na postrojenju za proizvodnju RDF goriva proizvodimo gorivo 4 MW/t. Tipske tvornice za industrijsku reciklažu su veliko tehnološko otkriće razvijeno u kompaniji Tehnix. Savjetujemo, projektiramo, proizvodimo, održavamo, servisiramo isporučena tipska postrojenja za potpunu reciklažu komunalnog otpada.

Dosadašnje tehnologije nisu niti mogu dati one rezultate kojima se sadašnja proizvedena količina otpada u svijetu može reciklirati. Sadašnji sustav postiže tek do 15% reciklaže proizvedenog otpada, ostalo se baca na neuređene deponije. MO-BO-TO sustav reciklaže omogućuje potpunu reciklažu bez deponija.



To je ogromni napredak u održivom gospodarenju komunalnim otpadom. Dosadašnja rješenja su skupa i teško provediva u praksi. Mi smo dosada izgradili preko 50 postrojenja raznih kapaciteta. Za svoje izume dobili smo puno svjetskih priznanja, surađujemo sa stručnjacima, akademijama znanosti u Europi i svijetu. Želimo da i Vi budete sljedbenik i korisnik naše MO-BO-TO tehnologije za reciklažu otpada kojom zajednički možemo zaustaviti klimatske promjene.

MO-BO-TO JE TRAJNO RJEŠENJE - VELIKA DOBIT OD RECIKLAŽE OTPADA

1. JEDNOSTAVNOST ODLAGANJA I SAKUPLJANJA OTPADA (1+1)
2. BRZINA SAKUPLJANJA, MANJE GUŽVE NA ULICAMA
3. VELIKO SMANJENJE TROŠKOVA RECIKLAŽE U TURIZMU
4. TIPSKE TVORNICE NE STVARAJU ZAGAĐENJA OKOLIŠA
5. BRZINA PROJEKTIRANJA I DOBIVANJA GRAĐEVINSKIH DOZVOLA
6. IZGRADNJA KOMPLETNOG MO-BO-TO POSTORJENJA ZA 10 MJESECI
7. POTPUNA RECIKLAŽA MIJEŠANOG KOMUNALNOG OTPADA
8. DOBIVAMO 8 VRSTA SIROVINA, EKO KOMPOST I RDF GORIVO (4MW/T)
9. ČUVAMO EKO-BAZU I POSTIŽEMO KRUŽNU EKONOMIJU
10. ISPUNJAVAMO CIJLEVE ZELENOG PLANA R. HRVATSKE I EU

Tehnologijom **MO-BO-TO** postižemo kružno gospodarstvo !

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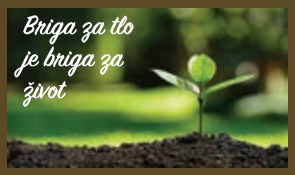
MO = mehanička obrada iz koje dobivamo 8 vrsta izdvojenih sirovina - plastične materijale, karton, papir, PET, MET, tekstil, staklo, metal. Sve sirovine su potpuno čiste, baliraju se i plasiraju na tržište za nove proizvode iz starih sirovina.

BO = biološka obrada organskog otpada i zelenog otpada. Postupak bioreaktorskog kompostiranja razvijen u Tehnixu omogućuje ciklus proizvodnje eko komposta u vremenu od 2 mjeseca. Kompostiranje se obavlja u potpuno kontroliranim tehnološkim uvjetima bez negativnog utjecaja na okoliš, bez zagađenja vode, zemlje i zraka u svim vremenskim uvjetima.

TO = termička obrada. Ostatak gorivog otpada, koji se zbog strukturne veličine i specifičnosti materijala ne može reciklirati ni izdvojiti u postupku automatskog izdvajanja, se suši, reciklira i automatski balira bez prisutnosti čovjeka te se koristi kao gorivo u cementnoj ili energentnoj industriji. Prosječna kalorična vrijednost RDF goriva je 4 MW po toni.

Primjenom i izgradnjom MO-BO-TO postrojenja ostvarujemo velike uštede u gospodarenju komunalnim otpadom, trebamo malo prostora za izgradnju u industrijskim zonama ili van njih. Dobivamo zatvoreni kružni sustav gospodarenja otpadom, trebamo 10 puta manje energije od dosada izgrađenih sortirnica, zapošljavamo ljude na recikliranju suhe frakcije, dobivamo kvalitetno kompost organsko gnojivo sa fosfatom, gotovo 50% od ukupne količine otpada čini RDF gorivo. Da bi se svijet održivo razvijao treba više sirovina, više organskog gnojiva i kvalitetnog goriva bez sumpora. Sve to postižemo izgradnjom MO-BO-TO eko sustava koji štiti podzemne vode, pitke vode, jezera i mora od trajnog zagađenja plastikom i beskonačnim deponijama.

Kompanija Tehnix Vaš je pravi partner u gospodarenju otpadom. Izgradnjom naših MO- BO-TO tvornica otvaramo privatne biznise, gradovi će raspisivati koncesije za održivo gospodarenje otpadom. Banke žele financirati MO-BO-TO postrojenje za reciklažu, zaposlit ćemo milijune ljudi na industrijskoj reciklaži. Kompanija Tehnix daje svoje izume i patente za očuvanje planete Zemlje kao zajedničkog doma svih.



PROJEKTIRAMO, PROIZVODIMO, ISPORUČUJEMO, GRADIMO I ODRŽAVAMO KOMPOSTANE ZA BIOREAKTORSKO KOMPOSTIRANJE KAPACITETA 1000 M3/G, 2500 M3/G, 5000 M3/G, 7000 M3/G, 10000 M3/G

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PROIZVODIMO - ISPORUČUJEMO - ODRŽAVAMO
NOVE INOVATIVNE TEHNOLOGIJE ZA BESKONTAKTNO ODLAGANJE, SAKUPLJANJE I OBRADU KOMUNALNOG I INFEKTIVNOG OTPADA

TEHNOLOGIJA BUDUĆNOSTI ZA BESKONTAKTNO ODLAGANJE, SAKUPLJANJE, SABIJANJE I PRIJEVOZ KOMUNALNOG OTPADA

1. Nadogradnje kamionskog podizača
2. Pokretanje pomoću pina
3. Pokretanje pomoću kartice
4. Pokretanje pomoću otiska
5. Pokretanje pomoću mobilne aplikacije

EKOMUNAL TEHNIX
SPECIJALNO
KOMUNALNO VOZILO
ZA SAKUPLJANJE I
TRANSPORT
KOMUNALNOG OTPADA
KAPACITETA
5 / 7,5 / 10 / 12 / 14 / 16 /
18 / 20 / 22 m³

CORONA KREMATOR
SPECIJALNO
POSTROJENJE ZA
TERMIČKU OBRADU
INFEKTIVNOG OTPADA

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Tehnix® TBR TEHNOLOGIJA BIO-REAKTORSKOG postrojenja za pročišćavanje otpadnih voda

Kompanija Tehnix vodeća je eko industrija za proizvodnju strojeva, opreme i postrojenja za održivo gospodarenje otpadom i pročišćavanje voda.

Stalno istraživanje i razvoj novih proizvoda bazirano na vlastitom iskustvu iz neposredne prakse daju nam razvojnu priliku da veliko teoretsko i praktično znanje ugradimo u nove tehnologije te time bitno doprinesemo zaštiti komunalnih voda i gospodarenju muljem.

Razvili smo i proizvodimo tipske mobilne uređaje biorotore. To su kompaktni modularni tipski uređaji koje proizvodimo u kapacitetima od 100 ekvivalent stanovnika do 2000 ekvivlaent stanovnika. Kapaciteti uređaja prilagođavaju se potrebama korisnika, a modelirani su od 100, 200, 400, 600, 800, 1000, 2x1000=2000.

Velike prednosti takvih uređaja su: brzo projektiranje, jednostavna ugradnja, mala potrošnja energije i prostora, trajna funkcionalnost, automatsko daljinsko upravljanje, jeftino održavanje, visoko kvalitetno pročišćavanje vode, kompletna oprema potrebna za nadzor, kontrolu te ispitivanje i na kraju zadovoljstvo korisnika.

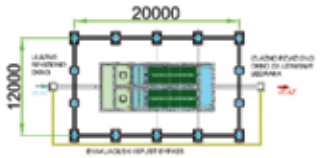
Dosada smo proizveli, isporučili te održavamo 350 uređaja raznih kapaciteta u svim uvjetima - naseljima, turizmu, industriji. Trajnu funkcionalnost postižemo ugrađenim INOX materijalima.

Nova suvremena generacija stacionarnih tipskih postrojenja pod nazivom TBR = tehnologija bioreaktorskog postrojenja za porčišćavanje otpadnih voda predstavlja održivu budućnost u zaštiti zagađenih voda. Zajedno s ovlaštenim projektantima, arhitektima želimo doprinijeti ekološkom i ekonomskom boljitku u zaštiti voda.

Čvrste montažne građevine s pocinčanom metalnom konstrukcijom dizajnirane prema želji naručioca, prema prirodnom prostoru i okolini omogućuju nosiocu i projektantu da stvori kreativni dizajn građevine koji će obogatiti prostor, a zadržati trajnu funkcionalnost. Tehnička modularna rješenja u svemu mogu zadovoljiti interese korisnika i pravilnika s kojim je definiran stupanj pročišćavanja.

Kompanija Tehnix svojim tehničkim rješenjima baziranim na iskustvu, razvijenim na suradnji europskih i domaćih eksperata, stručnjaka za biologiju, za otpadne muljeve i održivi razvoj sigurno može garantirati kvalitetu pročišćavanja otpadnih voda uz najniže troškove održavanja.

4000 ES



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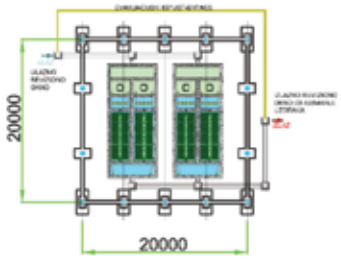

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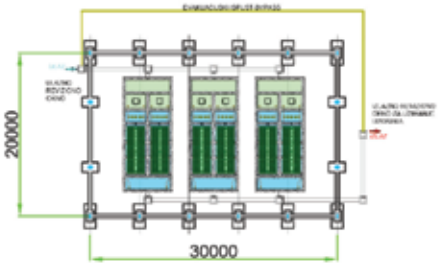

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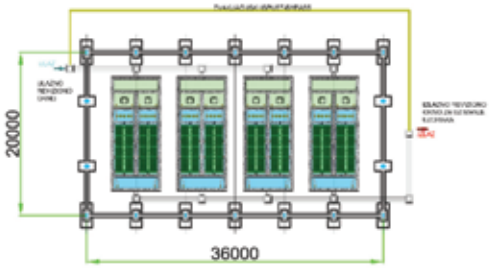

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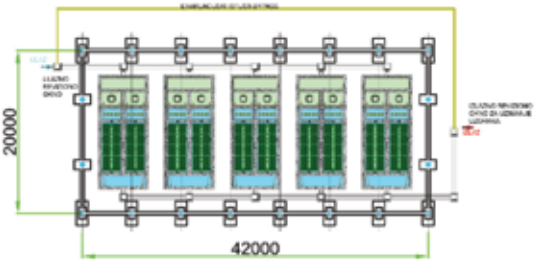

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UGRADNJA BIOROTORA TEHNIX BRT - 2000 ES U SKLOPU PROJEKTA ODVODNJA I PROČIŠĆAVANJE OTPADNIH VODA NASELJA BRESTAČA I NOVA SUBOCKA ZA GRAD NOVSKA

Tehnix®
EKO INDUSTRIJA

TEHNOLOŠKI PRIRUČNIK ZA BIOREAKTORSKO KOMPOSTIRANJE U KONTROLIRANIM UVJETIMA INOVATIVNOM TEHNOLOGIJOM TEHNIX

KOMPANIJA TEHNIX JE SVJETSKI LIDER U ZAŠTITI OKOLIŠA
RAZVILI SMO NAJBOLJU **MO-BO-TO** TEHNOLOGIJU ZA OTPAD

PRAVO RJEŠENJE ZA OTPAD SU TIPSKE TVORNICE - SORTIRNICE I BIO-KOMPOSTANE KOJE POTPUNO RECIKLIRAJU OTPAD PREMA UPORABNIM VRIJEDNOSTIMA I POSTIŽU CILJEVE KRUŽNE EKONOMIJE

NOVA STRATEGIJA EU-a O PRILAGODBI KLIMATSKIM PROMJENAMA TEMELJE SE NA ZELENOM PLANU EUROPSKE UNIJE

TRI GLAVNA CILJA NOVE STRATEGIJE SU:
PAMETNIJA, BRŽA I SUSTAVNIJA PRILAGODBA

POTREBNO JE INTENZIVIRATI MEĐUNARODNE AKTIVNOSTI ZA KLIMATSKU OTPORNOST U ZAŠTITI PLANETE ZEMLJE

EU PROJEKT

DEPONIJE SU NEODRŽIVO RJEŠENJE
VELIKE ŠTETE OD ODLAGALIŠTA OTPADA

1. VELIKI TROŠKOVI ZEMLJIŠTA ZA ODLAGANJE OTPADA
2. VELIKI TROŠKOVI IZGRADNJE ODLAGALIŠNE PLOHE
3. VELIKI TROŠKOVI ODLAGANJA OTPADA NA ODLAGALIŠTU
4. VELIKI TROŠKOVI ŠTETNIH EMISIJA IZ ODLAGALIŠTA OTPADA
5. IZGRADNJA MEMBRANSKOG UREĐAJA ZA PROČIŠĆAVANJE VODA
6. VELIKI TROŠKOVI IZGRADNJE TRAFOSTANICE I POTROŠNJA STRUJE
7. TRAJNO ZAGAĐENJE TLA I GUBITAK PLODNOSTI
8. TRAJNO ZAGAĐENJE ZRAKA ŠTETNIM EMISIJAMA
9. ZBOG SMRADA IZ DEPONIJA PADA CIJENA NEKRETNINA
10. NEISPUNJAVANJE CILJEVA ZELENOG PLANA EU I RH, ŠTETA ZA OKOLIŠ

MO-BO-TO JE TRAJNO RJEŠENJE
VELIKA DOBIT OD RECIKLAŽE OTPADA

1. JEDNOSTAVNOST ODLAGANJA I SAKUPLJANJA OTPADA (1+1)
2. BRZINA SAKUPLJANJA, MANJE GUŽVE NA ULICAMA
3. VELIKO SMANJENJE TROŠKOVA RECIKLAŽE U TURIZMU
4. TIPSKE TVORNICE NA STVARAJU ZAGAĐENJA OKOLIŠA
5. BRZINA PROJEKTIRANJA I DOBIVANJA GRAĐEVINSKIH DOZVOLA
6. IZGRADNJA KOMPLETNOG MO-BO-TO POSTROJENJA ZA 10 MJESECI
7. POTPUNA RECIKLAŽA MIJEŠANOG KOMUNALNOG OTPADA
8. DOBIVAMO 8 VRSTA SIROVINA, EKO KOMPOST I RDF GORIVO (4MW/T)
9. ČUVAMO EKO-BAZU I POSTIŽEMO KRUŽNU EKONOMIJU
10. ISPUNJAVAMO CILJEVE ZELENOG PLANA EU I RH

PORUKA ČOVJEČANSTVU

Jedna od velikih llekcija koju smo naučili iz krize izazvane pandemijom COVID-19 je povezanost ljudskog zdravlja i zdravlja planete Zemlje. Trenutno ni jedno ni drugo nije dobro i moramo činiti sve da to popravimo.

EKOLOGIJA MORA POSTATI ZNANOST KOJA SE BAVI ZDRAVLJEM PLANETE ZEMLJE.
ČISTI OKOLIŠ JE IZVOR ZDRAVLJA

TEHNIX je Vaš pouzdani partner za trajno rješavanje problema gospodarenja otpadom!

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STRUČNA LITERATURA MOŽE SE KORISTITI U PRIMJENI I PROVEDBI TEHNOLOGIJE	

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EKO INDUSTRIJA

Okrećimo zajedno ! Let's turning together !

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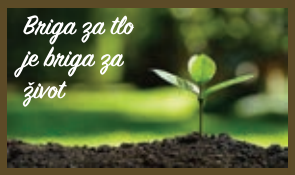
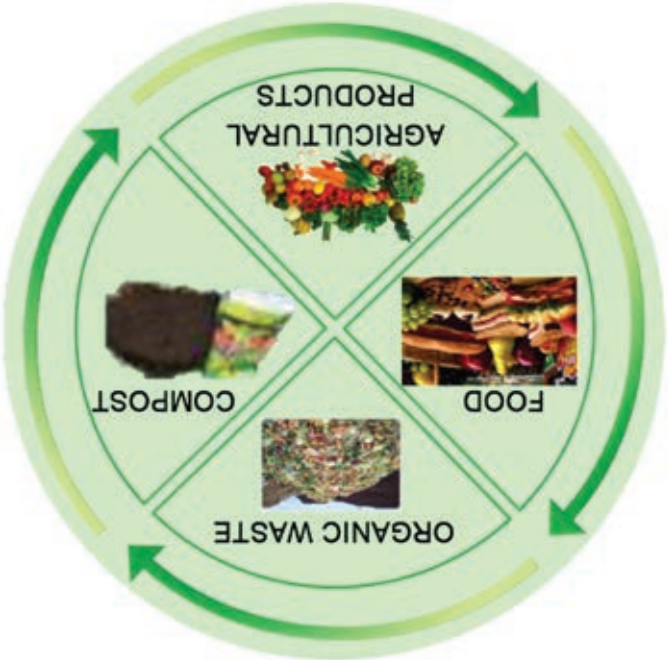


Briga za tlo je briga za život !

Caring for soil is caring for life !



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VANJSKI SURADNIK	Prof. Ph.D. Damir Ježek
Dr. Heribert Gisch, consultant by EVS Saar	Doc. Ph.D. Lovorka Librić
TEHNIX RESERVES THE RIGHT TO AMEND THE TEXT OF THE MANUAL	
PROFESSIONAL LITERATURE CAN BE USED IN THE APPLICATION AND IMPLEMENTATION OF TECHNOLOGY	

DESIGN - MANUFACTURE- SERVICE MAINTENANCE ENVIRONMENTAL PROTECTION EQUIPMENT AND MACHINERY, COMPOSTING MACHINES RDF FUEL PRODUCTION MACHINES, MACHINES AND EQUIPMENT FOR WATER TREATMENT

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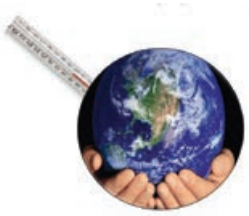
TECHNOLOGICAL MANUAL FOR BIOREACTOR COMPOSTING IN CONTROLLED CONDITIONS INNOVATIVE TECHNOLOGY BY TEHNIX

THE COMPANY TEHNIX IS A WORLD LEADER IN ENVIRONMENTAL PORTECTION WE DEVELOPED THE BEST MO-BO-TO WASTE TREATMENT TECHNOLOGY

THE RIGHT SOLUTION FOR WASTE ARE STANDARD FACTORIES = SORTING PLANTS AND BIO-COMPOSTING PLANTS WHICH COMPLETELY RECYCLE WASTE ACCORDING TO USEFUL VALUES AND ACHIEVE THE GOALS OF THE CIRCULAR ECONOMY



NEW EU STRATEGY ON ADAPTATION TO CLIMATE CHANGES IS BASED ON THE GREEN PLAN OF THE EUROPEAN UNION

THREE MAIN GOALS OF NEW STRATEGY ARE:

SMARTER, FASTER AND SYSTEMATIC ADJUSTMENT

INTERNATIONAL ACTIVITIES NEED TO BE INTENSIFIED FOR CLIMATE RESISTANCE IN PROTECTING THE EARTH

LANDFILLS ARE AN UNSUSTAINABLE SOLUTION
GREAT DAMAGES FROM WASTE LANDFILL

1. LARGE COSTS OF LAND FOR WASTE DISPOSAL
2. HIGH COSTS OF CONSTRUCTION OF A LANDFILL
3. HIGH COSTS OF WASTE DISPOSAL
4. HIGH COSTS OF HARMFUL EMISSIONS FROM LANDFILLS
5. CONSTRUCTION OF MEMBRANE DEVICE FOR WATER TREATMENT
6. HIGH COSTS OF ELECTROSTATION CONSTRUCTION AND ENERGY CONSUMPTION
7. PERMANENT SOIL POLLUTION AND LOSS OF FERTILITY
8. PERMANENT AIR POLLUTION BY HARMFUL EMISSIONS
9. THE PRICE OF REAL ESTATE FALLS DUE TO THE STINK FROM THE LANDFILLS
10. FAILURE TO FULFILL THE GOALS OF THE EU AND CROATIAN GREEN PLAN, DAMAGE TO THE ENVIRONMENT

MO-BO-TO IS PERMANENT SOLUTION
GREAT PROFIT FROM WASTE RECYCLING

1. SIMPLICITY OF WASTE DISPOSAL AND COLLECTION (1 + 1)
2. SPEED OF COLLECTION, LESS CROWDS ON THE STREETS
3. GREAT REDUCTION OF RECYCLING COSTS IN TOURISM
4. STANDARD FACTORIES DO NOT CREATE ENVIRONMENTAL POLLUTION
5. SPEED OF DESIGNING AND OBTAINING BUILDING PERMITS
6. CONSTRUCTION OF THE COMPLETE MO-BO-TO PLANT IN 10 MONTHS
7. COMPLETE RECYCLING OF MIXED MUNICIPAL WASTE
8. WE GET 8 TYPES OF RAWS, ECO COMPOST AND RDF FUEL (4MW / T)
9. WE KEEP THE ECO-BASE AND ACHIEVE THE CIRCULAR ECONOMY
10. WE MEET THE GOALS OF GREEN PLAN OF CROATIA AND THE EU

A MESSAGE TO HUMANITY

One of the great lessons we have learned from the crisis caused by the COVID-19 pandemic is the connection between human health and the health of planet Earth. At the moment neither is good and we have to do everything to fix it.

ECOLOGY MUST BECOME A SCIENCE DEALING WITH THE HEALTH OF THE PLANET EARTH. A CLEAN ENVIRONMENT IS THE SOURCE OF HEALTH

TEHNIX is your reliable partner for permanently solving waste management problems!

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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INSTALLATION OF THE TEHNIX BRT - 2000 ES BIOROTOR WITHIN THE SCOPE OF THE WASTE WATER DRAINAGE AND TREATMENT PROJECT FOR THE BRESTAČA AND NOVA SUBOCKA SETTLEMENTS FOR THE TOWN OF NOVSKA

Tehnix® ECO INDUSTRY TBR

TECHNOLOGY OF BIO-REACTOR WASTEWATER TREATMENT PLANT

Tehnix is a leading eco-industry for the production of machines, equipment and plants for sustainable waste management and water treatment.

Continuous research and development of new products based on our own experience from direct practice give us a development opportunity to incorporate extensive theoretical and practical knowledge into new technologies and thus significantly contribute to the protection of municipal water and sludge management.

We have developed and manufactured standard mobile devices, biorotors. These are compact modular type devices that we produce in capacities from 100 population equivalent to 2000 population equivalent. The capacities of the devices are adjusted to the needs of the users, and are modeled from 100, 200, 400, 600, 800, 1000, 2x1000 = 2000. The great advantages of such devices are: fast design, easy installation, low energy and space consumption, permanent functionality, automatic remote control, cheap maintenance, high quality water purification, complete equipment needed for monitoring, control and testing and finally customer satisfaction.

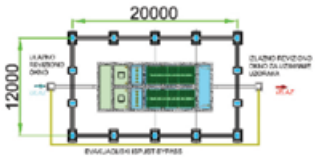
So far, we have produced, delivered and maintained 350 devices of various capacities in all conditions - settlements, tourism, industry. We achieve lasting functionality with built-in INOX materials.

A new modern generation of stationary type plants called TBR = bio-reactor wastewater treatment plant technology represents a sustainable future in the protection of polluted water. Together with certified designers, architects we want to contribute to ecological and economic improvement in water protection.

Solid prefabricated buildings with galvanized metal construction designed according to the customer's wishes, according to the natural space and the environment, allow the bearer and the designer to create a creative design of the building that will enrich the space while maintaining permanent functionality. Technical modular solutions can satisfy the interests of users and regulations by which the degree of purification is defined.

With its technical solutions based on experience, developed in cooperation with European and domestic experts, biology experts, waste sludge and sustainable development, Tehnix can surely guarantee the quality of wastewater treatment at the lowest maintenance costs.

4000 ES



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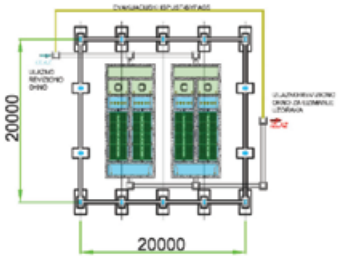

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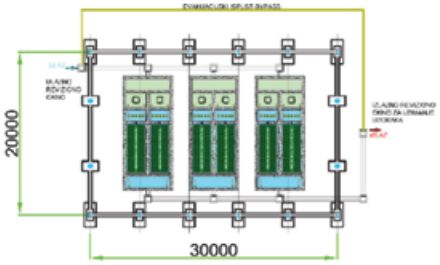

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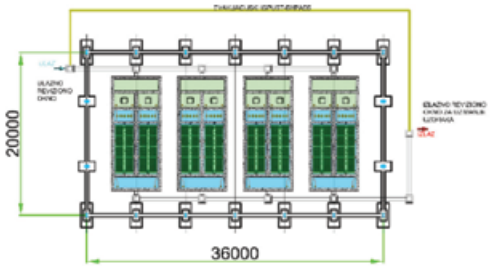

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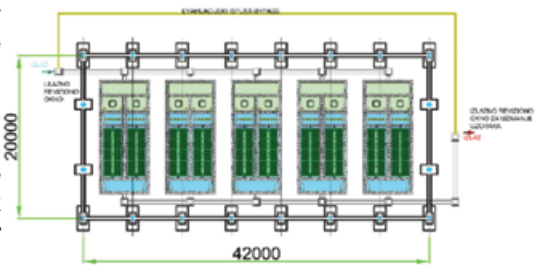

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PRODUCTION - DELIVERY - MAINTENANCE
OF NEW INNOVATIVE TECHNOLOGIES FOR CONTACTLESS DISPOSAL, COLLECTING AND TREATMENT OF MUNICIPAL AND INFECTIOUS WASTE

Tehnix® ECO INDUSTRY **PRESS-BOX 10 m³ - AUTOMATIC** = TECHNOLOGY OF THE FUTURE FOR CONTACTLESS DISPOSAL, COLLECTING, COMPACTING AND TRANSPORT OF MUNICIPAL WASTE

1. Truck lift upgrades
2. Pin startup
3. Card startup
4. Start by imprint
5. Start by using a mobile app

EKOMUNAL TEHNIX
SPECIAL MUNICIPAL VEHICLE FOR COLLECTING AND TRANSPORT OF MUNICIPAL WASTE
CAPACITIES OF
5 / 7,5 / 10 / 12 / 14 / 16 / 18 / 20 / 22 m³

CORONA KREMATOR
SPECIAL PLANT FOR THERMAL TREATMENT OF INFECTIOUS WASTE
PROTECTION AGAINST COVID-19

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IMPROVEMENT AND EQUIPMENT OF A SEPARATELY COLLECTED BIOWASTE RECYCLING PLANT IN WHICH THE TECHNOLOGICAL PROCESS OF COMPOSTING IN HEREŠIN IS BEING CARRIED OUT

WE DESIGN, MANUFACTURE, DELIVER, BUILD AND MAINTAIN COMPOSTING PLANTS FOR BIOREACTOR COMPOSTING CAPACITIES OF 1000 M3 / G, 2500 M3 / G, 5000 M3 / G, 7000 M3 / G, 10000 M3 / G

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MO = mechanical processing, resulting in eight types of separated raw materials Ð plastic materials, cardboard, paper, PET, MET, textiles, glass and metal. All raw materials are completely clean. They are baled and placed on the market for the manufacture of new products from old raw materials.

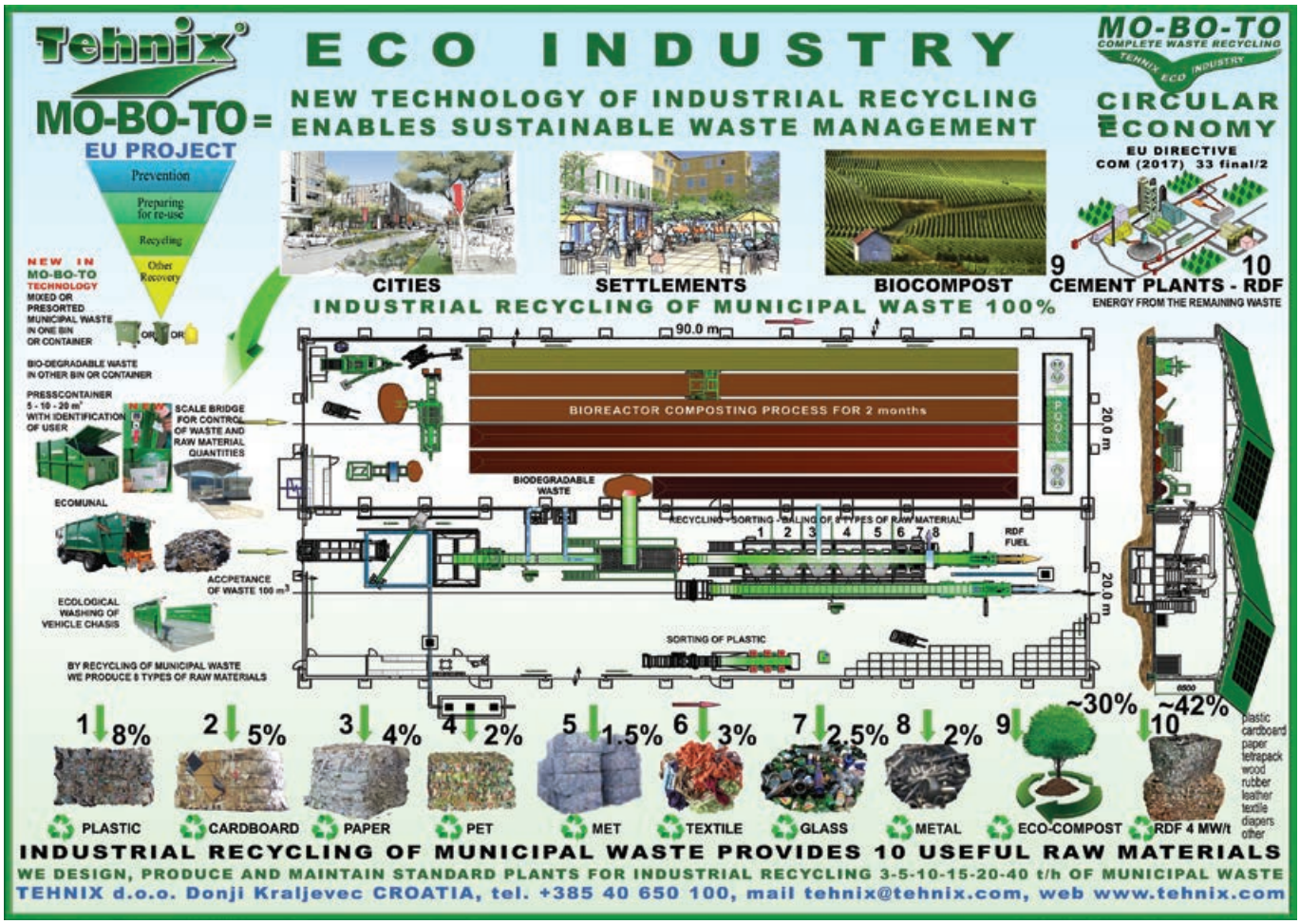
BO = biological processing of organic and green waste. The bioreactor composting procedure developed by Tehnix enables the cycle of environmentally friendly compost production in two months. Composting is carried out in completely controlled technological conditions without any negative impacts on the environment - without water, soil or air pollution in any weather conditions.

TO = thermal processing. The rest of the combustible waste, which can neither be recycled nor separate din the process of automatic separation due to its size and specific characteristics, is dried, recycled and baled completely automatically, without the presence of human operators. Iti s then used as fuel in the cement or energy industry. The average caloric value of RDF fuel is 4 MW/t.

With the application and construction of MO-BO-TO plants, we achieve great savings in municipal waste management. We also require very little space for construction in industrial zones or other places. We build a closed circular waste management system which requires ten times less energy than the existing sorting plants. We employ people who sort the dry fraction. We obtain quality compost organic fuel with phosphate, and almost 50% of the total amount of waste is made up of RDF fuel. For sustainable development, the world requires more raw materials, more organic fertilisers and quality fuel without sulphur. We can achieve all that by building the MO-BO-TO environmentally friendly system that protects the groundwater, potable water, lakes and seas from permanent pollution by plastics and endless landfills.

The Tehnix company is your true partner in waste management. With our MO-BO-TO plants, we open private businesses. Municipalities will publish concession tenders for sustainable waste management. Banks are interested in financing MO-BO-TO recycling plans, which has the potential to employ millions of people in industrial recycling. The Tehnix company provides its inventions and patents for the preservation of our planet as the common home of everyone.

This is a great advancement in sustainable municipal waste management. Solutions to date have been expensive and difficult to implement in practice. So far, we have built over 50 plants of various capacities. For our inventions, we have been awarded many recognitions across the world. We would like you to be a follower and user of our MO-BO-TO technology for waste recycling. With it, together we can stop the climate change.



MO-BO-TO IS PERMANENT SOLUTION GREAT PROFIT FROM WASTE RECYCLING

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10. WE ARE MEETING THE GOALS OF THE GREEN PLAN OF CROATIA AND THE EU

Using MO-BO-TO technology we achieve circular economy !

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MO-BO-TO IS AN INNOVATIVE TECHNOLOGY FOR COMPLETE RECYCLING OF MUNICIPAL WASTE

The TEHNIX company is the leading innovative environmentally friendly industry in the world. We have developed the MO-BO-TO recycling system that does not require a landfill. It is comprised of contemporary type-made plants for a complete industrial recycling of collected and delivered pre-sorted and sorted municipal waste. The daily capacities of MO-BO-TO plants are determined according to the number of inhabitants in the city, municipality or collective users using the formula of 1 inhabitant per 1 kg per day, meaning that 25,000 inhabitants produce approximately 25 tons of mixed municipal waste per day. Such a town needs a plant with the capacity of 2.5 t/h. For 50,000 inhabitants 5 t/h is needed; for 100,000 inhabitants, 10 t/h is needed; for 200,000 inhabitants, 20 t/h is needed, while for 400,000 inhabitants, 2 x 20 t/h are needed.

MO-BO-TO plants are built as prefabricated steel halls that can be upgraded or moved depending on spatial management. For more than 20 years, the Tehnix company has been investing in the development of the MO-BO-TO technology system. We can recycle 100% of any municipal waste within a day of delivery. The great innovative capacity of experts, engineers and associates has enabled the development and technological discovery of the greatest recycling industry. We recycle municipal waste according to its material and energy value, returning it for reuse in the industry. In such a manner, we achieve a circular economy and sustainable development of our planet.

The MO-BO-TO technology is a discovery by the Tehnix company. By using the MO-BO-TO technology by Tehnix, we recycle in the sorting plant to obtain eight types of pure baled raw materials. By separating biodegradable waste, we produce compost and organic fertilisers. In the RDF fuel production plant, we produce 4 MW/t fuel. The type-made plants for industrial recycling are a great technological discovery developed at the Tehnix company. We advise, design, manufacture, maintain and service delivered type-made plants for the complete recycling of municipal waste.

The technologies to date have not and cannot provide the results sufficient to recycle the amount of waste in the world nowadays. Today's system achieves only up to 15% of recycled waste, while the rest is disposed of on unregulated landfills. The MO-BO-TO recycling system enables full recycling without landfills.

Compost is an organic fertilised with a low to medium content of phosphorus, potassium, nitrogen, lime, various trace elements as well as a high content of relatively stable organic matter (humus). In agricultural applications, compost can completely cover the basic supply of phosphorus, potassium and lime, thus only additional fertilisation by nitrogen is needed. This makes compost an interesting substitute for more expensive mineral fertilisers for conventional agriculture. It is obtained from organic farmers. The normal range of quantities is 10-20 t/ha in three years.

The physical and biological effects of compost on the soil bring an additional advantage in the agricultural practice. Compost has a positive impact on plant health, increasing their resistance to pests and other negative natural impacts. Compost improves water absorption and storage capacity of the soil, improving its arability and trade. Moreover, compost has a positive effects on organisms in the soil, minimising the sensitivity of the soil to erosion. Due to its positive characteristics, compost is also used for gardens and garden landscapes, recultivation, forestry, vegetable gardens, garden centres and parks.

Sampling

A representative sample must be taken from the compost for a laboratory analysis of the relevant parameters. For that purpose, individual samples are taken from different points in the pile and combined into one sample. Individual samples of coarse materials must be taken in order to ensure a representative sample. If the particle size is smaller than 20 mm, an individual sample is necessary for each 10 t; if the particle size is larger than 20 mm, one sample for every 5 t of compost is required. The amount of material for each sample depends on the maximum particle size (d) of the analysed material, and can be calculated according to the following formula:

$$G\ (kg) = 0{,}06 \times d\ (mm)$$

The minimal size for an individual sample is then 0.6 kg for particles with the size of 0/10.

It is important to note that the manufactured compost can be enriched with additional mineral fertilisers, quality soil and humus. It is best to consult users of compost fertilisers, who can suggest the type of agricultural production and planned crops in the annual production cycle.

Healthy food is the best medicine for a one's long life.
Tehnix is your partner in the production of eco compost!

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NOTES:

The compost is too wet

Observations:	The compost is sticky and greasy, with a bad smell When pressed in a fist, water comes out.
Reason:	1. Soaked due to heavy rain 2. Too frequent and too intensive pile moistening 3. Incorrect mixture at the beginning of the decomposition process
Corrective measure:	1. Turn several times once the rain stops 2. Stop moistening, turn frequently 3. Add dry material (e.g. straw)

Appearance of unplesant smells

Observations:	Smell of rotting
Reason:	1. Insufficient aeration or ventilation 2. Excessive moistening of the pile 3. Emergence of an anaerobic process and resulting gas
Corrective measure:	1. Turn the pile and add dry materials 2. Add bulk materials (e.g. straw) 3. Cover the pile during heavy rains (e.g. with a membrane)

Delayed decomposition

Observations:	The temperature does not rise after turning (T<50 °C). The colour of the compost remains unchanged.
Reason:	1. Unsuitable composting conditions 2. The organic material is mostly decomposed
Corrective measure:	1. Check and correct the parameters (moisture content, pH value...) 2. Initiate the maturation stage

Quality of compost and use

Once decomposition s over, the compost is free from fertile seeds and plant remains. It is the result of the disinfection, which is monitored by means of routine temperature checks. The compost must also be free from any contaminants. Unwanted residues such as pieces of glass, metal, large rocks etc. must be collected from the surface either before or after the decomposition. The compost must be homogeneous and with a balanced nutrient profile. The water content up to 45% of the weight is expected for the loosening of the product, while 35% is the the maximum percentage of the weight for packing the material into bags. The quality of the compost must be good so that it can be sold with a good conscience for soil enrichment.

NOTES:

In the course of the refining of finished products, air separators can be used to reduce contamination by light materials (film). Furthermore, a solid material separator can be used (if required) for non-ferrous metals or roller separator for non-ferrous materials. Finished products must be protected from rain and stagnant water. The products are also protected from airborne seeds when they are covered by a membrane or foil.

Optimising the composting process

If the composting process is not proceeding as planned, the solution is always to turn the pile. The following is a list of the main irritants in the composting process, with the appropriate corrective measures:

Do not overheat freshly made compost piles (T<50 °C)

Reason:
1. Insufficient moisture
2. The C/N ratio is too high, lack of nitrogen
3. Raw compost material is insufficiently mixed or chopped up
4. Low pH value
5. Air temperature is too low

Corrective measure:
1. Turn and moisten
2. Add nitrogen material and turn
3. Turn several times, if necessary chop up the material again
4. Add calcium carbonate (CaCO3) and turn
5. Increase the pile volume, add fresh compost

Compost pile too hot (T>75 °C)

Reason:
1. The C/N ratio is too low, excess nitrogen
2. Accumulated heat in the pile

Corrective measure:
1. Add wooden material (cuttings, straw,...), turn and moisten frequently
2. Turn several times, moisten if necessary

Intensive bad smell of ammonia at the beginning of the intensive decomposition stage

Observations: The sharp acidic smell of ammonia (NH_3) can be detected. If the fumes are too strong, they can sting the eyes.

Reason:
1. Excess nitrogen (C/N ratio below 20:1)
2. pH value too high

Corrective measure:
1. Add high-carbon materials, e.g. sawdust or straw
2. Lower the pH value by adding acidic substances or avoid any basic substances such as lime and wood ash in the pile.

The compost is too dry

Observations: Less fumes released from the pile. Dust released during turning.

Reason: Too much moisture has evaporated due to the effects of heat, sunlight or wind.

Corrective measure: Turn and moisten the material.

NOTES:

Various materials are intensively mixed when the pile is turned, which should be done as soon as possible once the pile is built. The results of the mixing must be examined immediately. They can be improved with frequent turning if necessary. If the pile and mixture are optimally planned and prepared, there will be a significant increase in the pile temperature after only a few hours. If the temperature does not rise, there were errors in the pile construction stage. The composition, moisture content and structure of the pile must be checked and corrected if necessary.

The temperature of > 55 °C is necessary in the pile for two weeks for a reliable disinfection. The pile must be turned several times in order to ensure that the entire material has spent an appropriate amount of time in the pile core. The pile must be turned at least eight times, meaning at least once a week.

After the start of the disinfection process, no fresh material should be added to the pile in order to prevent reinfection. The pile temperature must be measured and recorded daily in order to obtain disinfection records. Temperatures of > 75 °C must be avoided, otherwise the decomposition process will come to a stop. The pile moisture content must be routinely checked, at least once a week. If necessary, the pile must be routinely turned and moistened.

Maturation

The maturation stage is the stage in which biological activities are slowed down in the pile, while the temperature drops below 55 °C. The compost is at that point regarded as fresh compost. If the decomposition process is properly controlled, the maturation stage begins 2-4 weeks after disinfection. The maturation phase serves to biologically stabilise the compost and reduce the emission of bad odours, which is still possible in fresh compost. The decomposition process is monitored by routine temperature and moisture checks as well as the assessment of the decomposition degree at the end of the process. The compost pile is then turned and moistened if necessary. The maturation stage begins when fresh compost turns into biologically stable finished compost, while the pile temperature drops below 45 °C. This is normally 6-12 weeks after the beginning of the intensive decomposition phase. It is generally no longer necessary to turn finished compost. Finished compost is then sorted using a procedure involving sifting and chopping up of large parts.

Refining (fine processing)

Refining, also known as grading, serves to make the final product and to remove contaminants. Technically speaking, refining is done by sifting. Depending on the required sizes of particles of the finished products, fine-mesh (up to 12 mm), medium-mesh (up to 25 mm) or large-mesh (up to 40 mm) sieves are used. The material remaining after the sieving can be generally reused for the composting of bulk material.

NOTES:

When low-volume organic waste is composted, bulk waste (chopped up wood and cuttings) must be added in order to ensure that the composting pile has a sufficient air pore volume. Material sifted from finished products is a good bulk material, provided that the level of contaminants is not too high.

Organic waste, waste from retail stores and sewer sludge must be processed particularly quickly, otherwise they will produce unbearable smells. A mixture of such low-structured materials and a suitable bulk material is possible in several ways. Apart from specially reinforced mixers that normally operate in the bulk mode, triangular pile turners are also very good mixers.

Intensive decomposition (initial composting / hot composting)

Intensive decomposition or the initial/hot composting stage is the first stage of composting. It is characterised by high temperatures and a high degree of composting of easily degradable organic matter. Due to the characteristic heat generated inside, the material is disinfected and pathogens are destroyed. In order to ensure the optimal start of intensive decomposition, it is necessary to pay attention to the construction of the compost pile because errors in that stage can have a negative impact on the whole composting process. They can be rectified only with great effort once the breakdown process starts. The ideal pile dimensions are 3 m in width and 1.5 m in height.

If compost materials of different moisture contents are combined together, the pile must be horizontal, with the dry material on the bottom and moist (such as sewer sludge) above. The optimal pile width and weight must be ensured for efficient turning and moisturising with bacteria.

Compost in the intensive decomposition stage

NOTES:

Stone and glass separators

Solid material separators are necessary in order to remove stone and glass from the compost. They take advantage of the difference in the elasticity and properties of hard materials in relation to softer compost particles. Compost is directed into special separation drums, while different bouncing properties of the materials are a result of their elasticity, which is exploited in order to remove the materials. In some cases, pneumatic concentrators are used to separate glass and stone (also for the separation of platelets or “airflocks”). Separation is carried out in accordance with the density of the particles and exposure to the airflow from the sieve cover. There are several devices and machines for sifting or air separators to remove rocks from large particles in the final sifting stage. Round particles (pebbles) are removed using fast conveyor belts with cylinder properties.

Composting using practical piles

Working with piles is the best way to manufacture environmentally friendly compost. Work in a composting plant is characterised by several routing tasks. All input material must be controlled and prepared for the formation of piles, with sizes according to the capacity of the machines.

Delivery of the material and removal of contaminants

Organic waste, green waste and other materials are examined during procurement. Batches not suitable for composting because they contain a high level of contaminants will not be accepted, and must be rejected. All other batches are weighted and recorded in a log along with their type, quantity and origin. After weighing and recording, the accepted material is unloaded from the truck and examined once again. The unloading and dispersion of the procured material on a flat surface has proven to be an effective practice. Contaminant can immediately be removed manually. To facilitate the removal of contaminant, organic waste can then be separated with a 20 mm or 50 mm sieve into coarse and fine fractions. Metal particles in a fraction can be separated using a magnetic separator on the discharge belt. The coarse fraction is released from other contaminants (plastic film, rocks) either manually or mechanically, and is added into compost as bulk material or sold as solid organic fuel as a part of RDF fuel.

Chopping up and homogenisation

Raw composting material can be chopped up in order to optimise the decomposition process. Bulk waste such as cuttings, branches and roots must be chopped up after it is delivered. The chopper opens up wood fibres to ensure a suitable surface for the settlement of microorganisms and moisture content. This is particularly important for bioreactor composting because the technologically best method of adding water enriched with cultivated bacteria and oxygen enables the highest-quality biological activity for uniform composting.

NOTES:

In essence, manufactured compost is not ready to be sold immediately after decomposition, but must be sifted (screened) in order to obtain the required particle sized in batches as needed or according to the customer's specifications. There are various sifting and screening machines on the market. The following list shows sifting machines used for the sifting of compost and their application:

Separation of contaminants

Separation of air

Separation of air, also known as airflow separation, is a mechanical sorting process with a chosen airflow. The sorted material is separated into two or more fractions depending on the shape and size of individual particles. Air separators are classified in three classes according to the direction of the airflow: cross-flow separators (air flows across the flow of the material), reverse-flow separators (air flows in the opposite direction of the flow of the material) and zig-zag separators (air flows across the flow of the material several times). Cross-flow separators have become the most frequently used for composting.

Air separators can be used at two points of the composting process:

1. When the input material is prepared before composting and decomposition for the removal of light materials such as films and plastic bags.
2. When finished compost is refined, for the removal of films of large particles that remained in the course of the final sifting stage so that they are clean and returned to the composting process after grinding in a rotary grinder.

Air separators are available as stationary and mobile devices. They are usually used for the final sifting of finished compost directly after the sifting machine removes coarse particles.

Magnetic separator

Metal particles are removed from compost using a magnetic separator, which removes iron and metal scraps from the flow of the material using an electric or permanent magnet. Many mobile devices (grinders, choppers, sifting machines...) are fitted with such a separator in the form of a magnetic drum at the output point of the conveyor belt or an above-ground magnet on the belt equipment. The ideal point of magnetic separator is at the output sections at the end of the conveyor belt since the whole of the material flows by the magnet - here, metal particles can be separated from the flow of the material the most easily.

NOTES:

Routine turning in the intensive decomposition phase ensures that, when the core and outer zones are mixed, all particles of the pile remain in the centre for a sufficiently long period, while high temperatures guarantee disinfection of the composting material so that the sprouts and seeds of wild plants are reliably destroyed.

Turning also ensures a higher degree of homogeneity and quality of the compost with repeated mixing and regular decomposition. The homogeneity of the material reduces the amount of material retained during sifting and increases the amount of compost.

How often should a pile be turned?

Turning can be regulated using time and the decomposition process as well as the degree of pile sedimentation (packing). The looseness of the organic material contributes to the quality of composting. During decomposition, organic matter mineralises. At the same time, the pile volume and weight are reduced.

The size and volume of the pores are reduced, which in turn means a lower flow of fresh air through the pile. The reduction of pore volume is resulting from the sedimentation of the pile has a negative impact on the living environment of aerobic microorganisms and restricts their activity. Once stopped, the pile temperature drops. The pile must be turned at the latest when its temperature drops to 5 °C in 24 hours. The composting technology changes according to the season. Countless times, the pile is turned depending on the type of the composted material, its structural stability, chosen size of the pile, pile sedimentation and state of decomposition. The general rule of thumb for turning:

- Intensive decomposition: turning 3-4 times weekly
- Maturation: turning 2-3 times weekly

Refining

Sifting and screening is necessary to refine finished compost or the soil and substrate produced from compost and other input materials.

Sifting

Compost and soil are naturally available in the following particle sizes:

- Fresh compost as an agricultural fertiliser	0/40 mm
- Fresh compost for mixing for gardening and landscaping	0/20 mm
- Fresh compost as a fertiliser for private gardens	0/10 mm
- Fresh compost for vegetable gardens (loose and packed)	0/10 mm
- Compost for recultivation	0/40 mm

NOTES:

Moisture

Watering the piles maintains the optimal level of moisture in piles for the best decomposition process. Watering is possible either manually or directly during turning, which is later the best method because the added moisture and bacteria are distributed even through the pile in the course of the turning. The optimal pile dimension is 3 m in width and 1.5 m in height.

Turning - why is it necessary?

In the decomposition process, the air-water-soil ratio of the compost pile is changed during the microbial decomposition and natural effects. The compost pile undergoes local changes in the structure and redistribution of moisture. Due to the weight of the material above, the lower layer of the pile is packed. Excess moisture collects on the bottom of the pile. In order to ensure regular and homogeneous conditions for the decomposition of the entire pile, regular turning is necessary and important.

As a result of turning, the material is loosened and enables an influx of oxygen. Microbial activity is restimulated, with results in an increased temperature. The influx of oxygen prevents anaerobic zones and anaerobic processes as well as bad smells. During turning, dry and moist parts of the pile are mixed together, making the moisture more uniform.

NOTES:

Principles of the decomposition process

Material preparation

The material delivered to the composting area is normally in the state unsuitable for direct composting. Branches and shrubbery, bushes, tree cuttings, wood from stumps and trunks as well as grass, straw and leaves must be chopped up prior to the creation of a compost pile in order to ensure the optimal decomposition process.

There are many machines available on the market for such a task. There are two types in principle: high-speed machines (hammer crusher, hammer mill, cutting mill etc.), also known as choppers or grinders, and low-speed machines (single-roll or two-roll mills, screw mills), also known as breaking machines.

The material is normally passed through an integrated sieve as it comes out of the machine so that the product contains particles of a pre-defined size. The range is 50-150 mm. The material is generally very fibrous, with numerous freshly broken surfaces where microorganisms can easily settle. The more uniformly the material is chopped up, the more uniform, shorter and higher-quality the production of environmentally friendly compost is

Controlling the decomposition process in controlled piles formed according to the capacity of the technological conditions

Oxygen

A compost pile system not infused with carbon dioxide must ensure that fresh air can be dispersed in the middle of the pile before turning. For that reason, in piles not infused with carbon dioxide, it is very important to pay attention to the proper ratio between the cross-section of the pile, the mixture of the material (particularly the volume of the air pores, temperature or oxygen-controlled aeration...) in order to ensure that the aerobic process is active in the piles.

A sufficient oxygen supply can also be optimised by means of an additional aeration system along with regular rotation of the piles. Artificial aeration of compost piles allows for larger piles and lower spatial requirements. There are various methods of aeration (e.g. Positive or negative aeration pressure, temperature- or oxygen-controlled aeration) in order to ensure an active aerobic process in the piles.

NOTES:

pH value

Microorganism activity as well as the time and density of the decomposition process impact the pH value of the composted material. The pH value in the basic range up to 11 does not have a negative impact on the decomposition process, but a pH value significantly below 7 in composted material slows down microbial activity, particularly at the beginning of the decomposition process. The microbial phase - which features hardly any growth because the bacteria must adapt to the new environment, and their metabolic activity is focused on division - increases exponentially with the increase of the pH value. At pH values below 5, a significantly restrictive impact can be noticed.

The pH value must be measured in the first week of composting and at the end of the composting process. In case of a disturbance in the decomposition process, pH value measurement is a recommended method of identifying the reason. The pH value can be measured using an electrode, or less commonly with litmus paper tests that change colour depending on the pH value. The electrodes and litmus paper are shown in the Appendix.

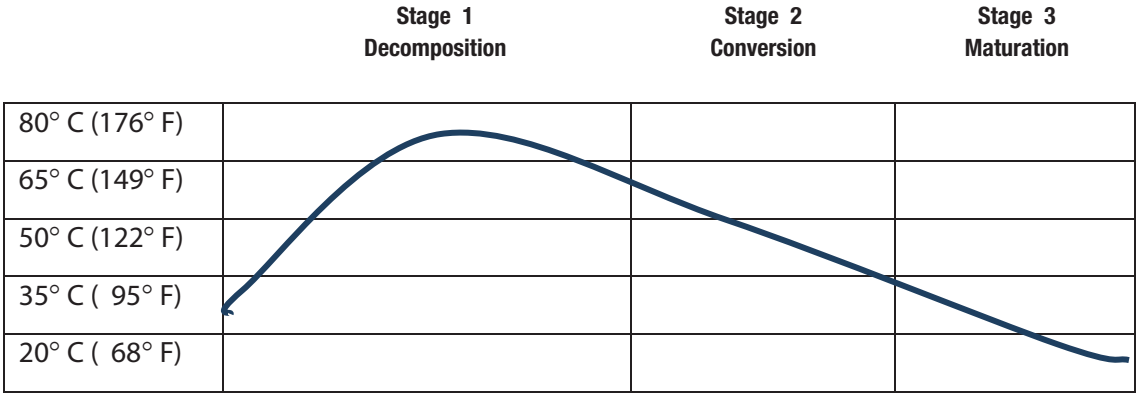
Degree of decomposition or maturity

The degree of decomposition or maturity is used for the estimation of the decomposition process and biological stability of the compost. The degree of decomposition can be determined using a simple self-heating test, which may last for several days. As the result of the test, the compost is evaluated as fresh or finished compost. Fresh compost is disinfected, decomposing material is immediately and intensively decomposed or decomposing materials with the ability of intensive breakdown. Finished compost is disinfected, biologically stabilised compost.

Another simple and much quicker method is the determination of maturity using the SOLVITA test. The results are available after four hours. Apart from the information about the biological stability, they also provide the information about any errors in the decomposition process. For further information, visit www.solvita.com.

NOTES:

If the decomposition is proceeding normally, the temperature curve in the compost pile and rows follows the characteristic curve.



Compost furrow temperature curve during decomposition

Stage 1: decomposition stage / composting week 1-4/T = 55-70 °C

Heat is generated by the metabolic activities of microorganisms found in the decomposing material. There are more thermophilic microorganisms, which can generate multiple explosions. In this stage, the composting material is disinfected. Most of the seeds remains sterile. Pests are killed. First, soluble compounds such as amino acids and soluble proteins, sugar and fatty acids are broken down. At the end of the decomposition stage, the decomposed material breaks down to its constituent parts so that thermophilic microorganisms can cease their activities and die out. They serve as nutrients for other microorganisms and fungi. The temperature drops. The decomposing material changed colour to brown or black and brown, the juicy green raw material is no longer recognisable.

Stage 2: conversion stage / composting week 4-8/T = 35-55 °C

The resulting conversion is slower. Apart from bacteria, fungi (mesophilic mixed flora) is also more active. It has specialised in decomposing substances that are hard to break down such as cellulose and lignin (wood). Later on, they will be particularly significant for the formation of humus. At the end of the conversion phase, the temperature settles at 30-40 °C.

Stage 3: econstitution and maturation phase / from the 8th week of composting / T < 35 °C

The formation of humus matter commences. Apart from microorganisms, numerous small organisms such as mites, collembolans and nematodes infest the decomposing material. They inhibit the growth of fungi. Compost worms combine the mineral and organic fractions, producing the so-called complex clay compost. Mature compost can be recognised by its colour; the humus matter gives it a dark brown colour. The loose and crumbling structure indicates that the decomposition process has ended. In order to monitor the decomposition process, particularly disinfection, the temperature must be measured at least daily through the pile and recorded.

NOTES:

Pore volume

As described above, both air and water are necessary in order to bring oxygen to microorganisms. Both compete with one another because they use the pores (cavities) between the compost pile particles. The pore volume of the compost pile depends on the input material. For that reason, the organic material should be pre-processed (slicing, agitating) at the beginning of the composting process so that it has an effect on the pore volume, resulting in more oxygen and water content.

An adequate oxygen supply is only guaranteed if there is an adequate pore volume in the pile, ensuring that all particles are sufficiently covered by water, and that there is a free and adequate airflow. This is guaranteed by the amount of the bulk material in the pile body; its content is loose at the beginning of the decomposition process and due to regular turning.

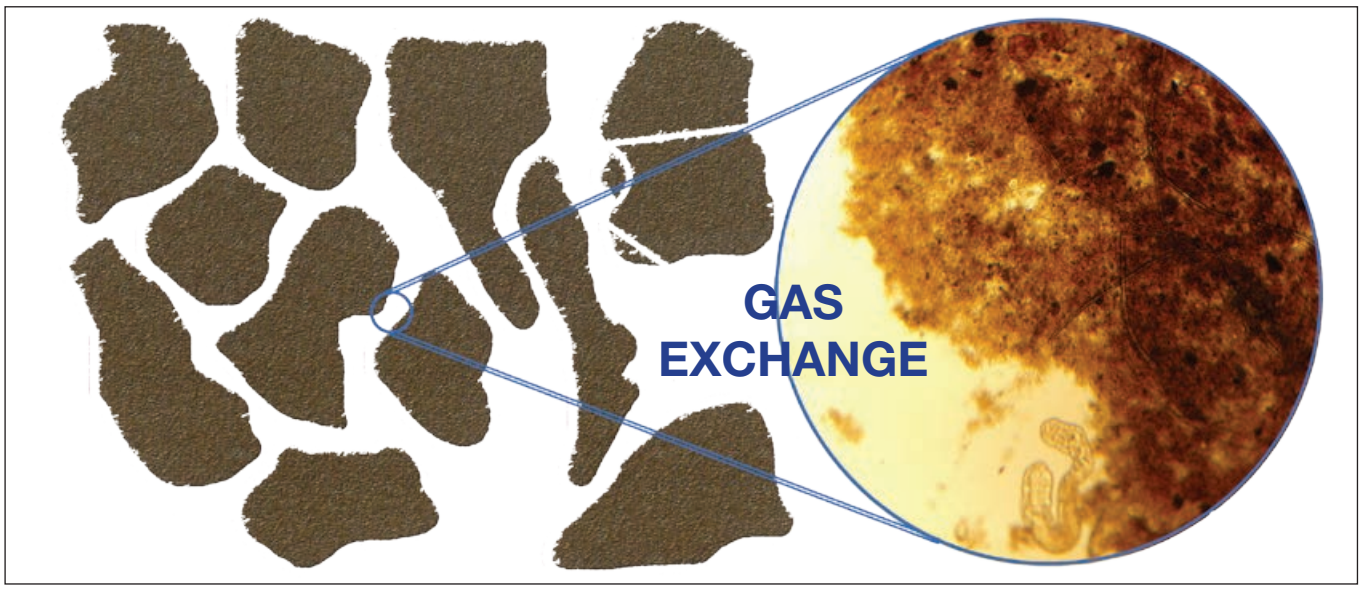
It is necessary to turn the piles to make up for the packed static body of the pile due to the size. The effect of the loosening and agitating is crucial because the effect of the full replacement of pores due to the turning is negligible. Practical measurements have shown that the oxygen content of the air in the pile in fresh compost drops to 0% within 60 minutes, but in the following several hours it rises to the level of 15-20%. The phenomenon can be explained by the fact that, during the turning of the pile, the smoke effect is negated by the total redistribution of all particles in the pile body, which comes back once the pore volume is sufficient.

Temperature

Organism activity is the basis for heat generation. The temperature in the pile body is the most important indicator in the composting process for the course of the decomposition. In order to ensure decomposition, particularly proper recovery, the temperature must be measured at least once a day along the pile and recorded. Measurement can be done using various instruments (analogue, manual). Whatever the method, the measurement probe must be inserted through the core of the pile due to different temperatures inside.

Various countries have different regulations laying down how the temperature is to be measured (e.g. Ordinance on biowaste), providing for continuous measurements in different parts of the pile with the appropriate data recording and storage for five years. The Appendix contains the “Composting Log”, where temperatures can be entered for monitoring purposes.

NOTES:



Overview of the clean structure and absorption of oxygen *(source: compost plant operating manual))*

The fresh air requirements also depend on the organic matter content in the compost pile. Taking into consideration the temperature of the pile and related oxygen solubility, the theoretical requirements are 1-2 litres of oxygen per kilogram of organic materials, i.e. 4-8 litres of air per kilogram of organic material per hour. Assuming that the organic waste content in the input materials is cca. 80%, the theoretical air requirements of a fresh compost pile with the density of 0.5 t/m^3 are 1.6-3.2 m^3 of fresh air per m^3 of compost material.

In triangular piles, the so-called smoke effects result in a constant air exchange in the pile pores. The warm air from the pile comes out on the top. Fresh air is drawn to the bottom of the pile by suction. This results in a flow of fresh air through the pile, ensuring that the pile is well-ventilated, depending on the material and pile size.

It is also possible to promote fresh air intake using active aeration, which is particularly necessary in large piles and those with small pores (insufficient bulk material or too much moisture). In practice, normal venting rate ranges from 3 to 10 m^3 of fresh air per m^3 of compost material per hour.

Special instruments for the determination of the oxygen contents in the piles are available. If such instruments are not available, our prediction can be a good substitute for the determination of the oxygen content. Try smelling a fistful of the decomposing material. If it has an earthy smell, fresh and aromatic, it indicates a sufficient quantity of oxygen, while an acidic, rotting smell indicates a lack of oxygen.

If the compost pile becomes smaller and collapses in several hours, it can also point to a lack of oxygen. Industrial composting should be accompanied by a laboratory equipped with measurement instruments for the monitoring of the technological process. It is important to ensure enough room and a quality preparation of the biomass.

NOTES:

The accurate list of the C/N ratio in organic materials as well as the good ratio is provided in the Appendix. The new composting technology developed by Tehnix enables the production of environmentally friendly compost in two months. The dosing of bacteria, water and air in covered controlled conditions enables the production of an organic fertiliser for the production of healthy food. Microorganisms require enough moisture for optimal development because the necessary oxygen is absorbed in the liquid phase. The average water content of compost piles must be 40-50% (by weight). If the moisture content is too low, the oxygen supply is insufficient, the bacteria culture becomes inactive, and the decomposition process slows down or even comes to a stop. If the water content is too high, the oxygen in the air is pushed into cavities, promoting rotting. The results are an unpleasant smell and slowing down of the decomposition process. In practice, the right moisture content can be determined by testing the material in a fist

Too dry

Too moist

The right level of moisture

Take a fistful of the material from at least 20 cm inside the heap (careful - the material might be very hot) and squeeze it firmly in your fist. If the material is too dry, it breaks apart once you open your first. If the material is too moist, water oozes between your fingers when you squeeze. If the moisture content is ideal, the sample stays ball-shaped in your open fist. The material feels like a dried sponge.

Oxygen requirements

In practice, the oxygen necessary for the aerobic decomposition process is fed into the composting material through fresh air (air from the environment), which contains around 21% of oxygen. The pure oxygen injection method tested in the past was discontinued because it was too expensive. However, microorganisms responsible for the decomposition process are unable to use oxygen directly from the gaseous phase of fresh air. The oxygen contained in the air must first be dissolved in the liquid phase, and only then does it become available to microorganisms. Therefore the moisture content of the piles is important. If there is enough moisture in the piles, solid compost particles will be covered

By a water film that absorbs a portion of the oxygen in the air, making it available to living microorganisms on the surface of the compost particles. The maximum oxygen absorption capability of the liquid phase is determined by the temperature of the system, dropping as the pile temperature rises. At the same time, the requirements for fresh air increase.

NOTES:

BIOREACTOR COMPOSTING IN CONTROLLED CONDITIONS

OPTIMAL MOISTURE IN THE PRODUCTION OF COMPOST
WATER PREPARATION IN RAINWATER AERATION TANKS
CONTROLLING THE TEMPERATURE OF THE BIOLOGICAL REACTION

Decomposition process - important parameters for the industrial production of environmentally friendly compost

Industrial composting is under the impact of numerous important parameters of the technological process. The main parameters are described below, with their influence on the impact of composting and microorganism behaviour. In order to achieve rapid composting, the following conditions must be in place:

- Supplying with nutrients: the main nutrients are carbon (C) and nitrogen (N), which must be available in sufficient quantities, the right ratio and planned time.
- Oxygen supply: a constant influx of fresh air into the decomposing material is necessary in order to ensure a good supply of oxygen, water and bacteria.
- Temperature: most microorganisms are active in the process of composting and An intensive decomposition process starts in the termophilic range and matures in the mesophilic range.
- pH value: most microorganisms prefer a pH-neutral value

Carbon/nitrogen ratio

The C/N ratio describes the volume of the ratio of carbon to nitrogen in organic compounds. In the lower ratio, closer C/N ratio and onwards, more nitrogen is allowed. The carbon to nitrogen ratio in the input materials determines the speed and development of the decomposition process. The decomposition of organisms requires energy-rich carbon compounds (C) to sustain the stable life process. Nitrogen (N) compounds requires the building of proteins for growth and reproduction. Without a precise C/N ratio in the input materials, the process slows down and even comes to a stop in extreme cases.

As a general rule, for rapid decomposition and a high quality of compost, more carbon than nitrogen is required. A good C/N ratio is in the range of 30:1 (1 part nitrogen to 30 parts carbon). If the ratio is higher than 40:1, there is a lack of nitrogen and microorganisms are unable to develop properly. That means that the decomposition is slow and results in low-nutrient compost. If there is a lack of carbon (ratio lower than 20:1), microorganisms are unable to form enough substances required by their own cells. In such cases, they consume and bind less nitrogen. That means that nitrogen is lost and released as a large amount of gas into the atmosphere in the form of ammonia (NH_3, which has a characteristic bad smell) or is washed out as a nitrate (NO_3^-). For piles, the C/N ratio must be taken into account in the input material mixture. It is calculated on the basis of the C/N ratio of individual substances in relation to their shared volume in the mixture.

NOTES:

8. PACKAGING OF ENRICHED COMPOST ACCORDING TO USERS NEEDS

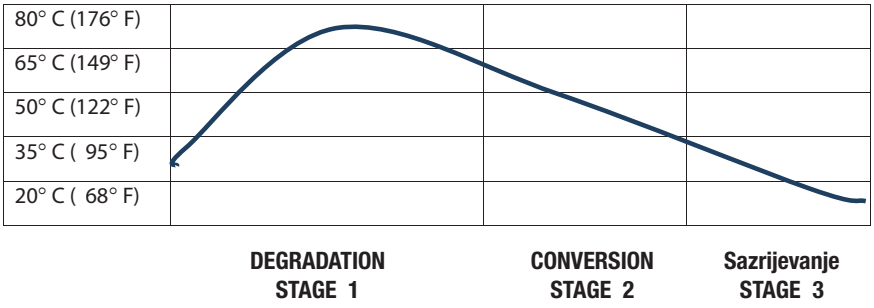
Production of quality compost in controlled conditions is a technological process controlled and supervised by a professional, having measuring instruments, which can control the process of biodegradation in controlled conditions without negatively affecting the composting process. Great experience, knowledge and perseverance surely lead to success. The value of obtaining quality eco-compost and its use in the cycle of the circular economy, from landfilling to the way the sieve works, is immeasurable.

In most today's cases, the resulting compost can be enriched by adding mineral fertilizers or quality humus, which increases its value and achieves the breadth of application in agricultural eco-production of healthy food for the market, which is enriched with phosphorus and other minerals needed in healthy food production. The optimum capacity of the composting plant is achieved from 10,000 population equivalent to 100,000 population equivalent. Larger capacities need to be harmonized and optimized for green biomass, which significantly increases in summer conditions.

NOTES:

7. TEMPERATURE CONTROL OF THE BIOLOGICAL REACTION OF COMPOST

TEMEPERATURE CONTROL



The activity of organisms is the basis for the initiation of heat. The temperature in the furrow body is the most important indicator during composting for the progress of the decomposition process. To ensure the decomposition process, and in particular to ensure proper remediation, the temperature must be measured at least once a day along the furrow and recorded. Measurement is possible with various instruments (analog, manual). However, the measuring probe should be passed through the furrow core due to different internal temperatures.

In different countries, there are different regulations that determine temperature measurements (eg the Ordinance on Biowaste), which provides for continuous measurements in various parts of the furrow with appropriate data reports and storage of these data for five years. The appendix contains a “Composting Log” in which the temperature is entered for monitoring purposes.
If the decomposition occurs correctly, the temperature curve in the compost furrow and rows follows the characteristic curve.

Temperature control is performed using a thermometer on which a 0.5 m long probe is installed, which is inserted into the formed compost furrow. This is the optimal temperature on the basis of which we determine the optimal process of further technological processing of biomass in the furrows. A handy laboratory should be established for the quality of eco compost production.

NOTES:

6. WATER PREPARATION IN AERATION POOLS ATMOSPHERIC WATER POOL VIEW FOR ATMOSPHERIC WATER

VIEW OF A POOL FOR ATMOSPHERIC WATER

The plant is equipped with aerators - air dispensers. A special dispenser of bioactive agents that are activated in aerobic pools should be installed in the system. It is necessary to make a housing container as an office in which the equipment for water treatment with oxygen for dosing bioactive substances will be located. The special container must have special equipment, appropriate electrical installation, connected pipelines for reciprocating compressors, pipe installations and a control table for the operation of the plant. The container must be insulated, equipped with a living system and electronic informatics. Such a system is directly connected to a 150 m^2 pool, which is used to collect roof and surface water. The pumps for filling the composter with water have rubber pipes that quickly dose the 1,000 liter tank. It is necessary to equip the aerobic pool with an overflow system and a system for replenishing water from the public system. By building an aerobic system for the preparation of rainwater, we are completing a new technological unit that enables eco-composting of biodegradable and organic waste, and the same one is returned to green production. With such a complete technology, we achieve a circular economy

NOTES:

5. CONTROL OF OPTIMAL HUMIDITY OF COMPOST

CONTROL OF OPTIMAL HUMIDITY IN COMPOST PRODUCTION

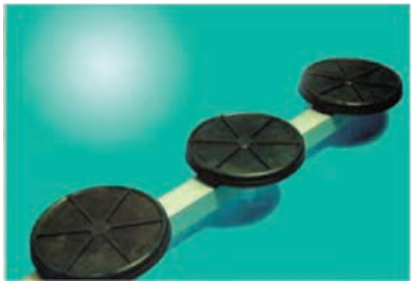
WATER PREPARATION IN RAINWATER AERATION POOLS

CONTROL OF THE TEMPERATURE OF THE BIOLOGICAL REACTION OF COMPOST

TOO WET

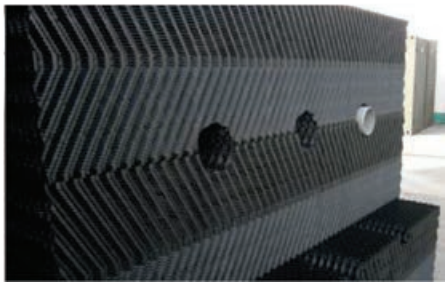
TOO DRY

CORRECT HUMIDITY



DIFFUSER

TEMPERATURE CONTROL



ABSORBENT BIOBOX

a) The control of compost moisture in furrows is a very important procedure of supervision and recommendation that must be done in order to obtain optimal conditions for biological decomposition of compost mass in furrows. There are three levels of humidity; too low when the affected biomass is compressed by the grip of the hand, it is gooey and too wet, it is kept in a pile and the water drains. Another extreme case of too dry biomass is when everything is scattered by hand and there is no homogenization. Third, the optimal control mode allows for optimal biomass binding. It is also an indicator of an optimal, controlled process of wetting and compost production.

b) Water preparation in the aeration pool is an important technological process. All precipitation roof and surface waters go through a pipe collection system into a collection basin with a volume of 30-200 m^3, depending on the catchment area. In these pools, rubber aerators are placed 0.5 meters from the bottom to enrich the water with oxygen and biological preparation of cultivated bioactive agents. Aeration is maintained by air blowers through diffusers in the accumulated water. The control and monitoring system is located in an above-ground container in which the sanitary part that enters directly into the aeration pool is located.

c) Temperature control is performed using a thermometer on which a 0.5 m long probe is installed, which is inserted into the formed compost furrow. This is the optimal temperature on the basis of which we determine the optimal process of further technological processing of biomass in the furrows. A handy laboratory should be established for the quality of eco compost production.

NOTES:

4. BIOREACTOR TURNING WITH ADDITION OF WATER, BIOACTIVENTS AND OXYGEN

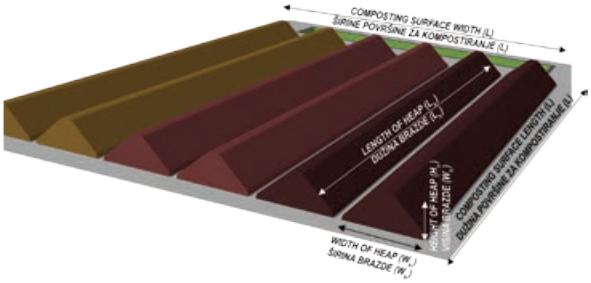
Special furrow turning machines have several technological functions that significantly contribute to the production of quality eco-compost. Today's turning technology enables optimal wetting with water enriched with special bioactive agents, which are grown in special purpose laboratories for the production of eco-compost from prepared materials for biodegradation. Composting in furrows is the fastest and most economical one.

A 1000 liter water tank is located on the turning machines. Diffusers for oxygen enrichment are mounted inside the tank. Dry bioactive agents are added to the water, which are revived by the aeration process, and they are added in a controlled manner to the formed furrows through two laterally located nozzles.

When turning the furrows, we add water, bioactive agents and oxygen, which actively acts on the rapid development of targeted biological reactions to biomass. The turning speed of a bioreactor machine depends on the given conditions by the turning technology which must obtain the optimal technological conditions of bioreactor decomposition. The rotary tube has screwed toothed spirals for air intake and furrow formation.

NOTES:

3. FURROW FORMATION FOR OPTIMAL COMPOST PRODUCTION PROCEDURE



The formation of furrows for the production of eco-compost is crucial for the further process of biodegradation quality in the bioreactor composting process. For planned furrows of optimal dimensions according to the technological conditions of machines and equipment, today's technology enables and recommends furrow dimensions of 1-4 meters wide. The optimal dimension is recommended from 3 meters wide to 12 meters high. In this way, we get a greater technological opportunity to obtain high quality compost and the fastest compost production processes. New developed technologies of bioreactor composting have led to a higher degree of economy of compost production and takes significantly less space and time for the production of eco-compost. Furrow formation is done in combination, with machines and manually, so that a uniform furrow dimension is obtained. Stacking the furrows according to the structure of the waste is done in the following order. The furrow base is made of the largest materials from green waste, branches, tree bark and other, while the middle layer is formed from biodegradable household waste, and the densest part of organic waste is formed at the top, so that oxygen flows from the bottom to the top. Automatic furrow turning machines and the ones that add water, bioactive materials and oxygen require the formation of furrows of typical dimensions. It is important to technologically mark the width and amount of furrows on the concrete, impermeable base that is dilated.

NOTES:

2. PREPARATION OF ORGANIC BIODEGRADABLE WASTE FOR COMPOSTING AND GOOD PREPARATION OF BIOMASS

Preparation of composting materials is the most important technological part of the production of quality eco-compost that can be used in eco-agriculture. Organic waste from municipal waste collected in mixed municipal waste or specially collected from citizens in bins or bags must also be technologically prepared, crushed before furrowing. It is important that the dosing technology on the roto sieve already has a system for shredding fruits, vegetables and other organic waste. Branches, shrubs, bushes, tree cuttings, tree barks, wooden forms up to Ø12 mm, longer lengths, Christmas trees, park cleaning greenery, leaves, dry and green grass must be prepared, all of which must be chopped, grind to the optimal thickness and length to obtain a quality composting mass. The formation of furrows from the prepared green mass is done in such a way that such material is placed as the bed of the furrow, while on top of it waste from households if places, then waste from processing fruits and vegetables, olive pomace, grapes, while the top of the furrow wastes from waste water treatment plants should be placed. Of course, care must be taken to prevent composting from becoming sludge that is saturated with detergents, acids, alkalis or pesticides, which in biodegradation have a negative impact on the development of bacterial colonies, which produce compost through their activities. Machines and equipment for the preparation of biomass for compost production should be selected according to the optimal need of use, so that they do not consume a lot of fuel, oil and do not pollute the space inside the hall. They must be mobile with a dosing system and have an occupational safety certificate.

NOTES:

1. INDUSTRIAL COMPOSTING FACILITIES FOR THE PRODUCTION OF ECO COMPOST SPECIAL CONSTRUCTION

SPECIAL PREFABRICATED HALLS ENABLE CONTROLLED TECHNOLOGICAL PROCESS UNDER CONTROLLED CONDITIONS

IT IS IMPORTANT TO ENSURE DIRECTED AIR CIRCULATION

Industrial composting must take place under controlled protected conditions. This means that the entire technological process of eco-compost production is controlled. The most important part is to determine the spatial capacity of furrow composting. The dimensions of the covered hall are determined according to the number of users and the environment in which the building for eco composting is built. The composting hall must be equipped with water, electricity, composting equipment and a rainwater pool. The height of the hall is harmonized with the facility of recycling and sorting of municipal waste. Composting belongs to the technological process of recycling, which means the separation of organic and biodegradable material that is converted into quality fertilizer. It is important to determine the optimal space capacity for bioreactor composting. The roof of the hall can be made of concrete, panels or sheets lined with felt. It is most economical to build a compost hall next to the sorting plant. The building itself must meet the conditions that there is no rain, wind, snow or leaking of liquids in the area around the composting plant or in groundwater. The building itself must be surrounded by a wall 3 meters high to prevent hypothermia by the strong winds or flushing of furrows in rainy conditions. The base of the hall for compost production should be made of impermeable reinforced concrete, the doors should enable the delivery of materials and removal of compost. The project must meet spatial and environmental requirements. The daily amount of biodegradable waste is approximately 0.2 kg/capita.

NOTES:

PRODUCTION OF ECO COMPOST IN 8 WEEKS IN 8 STEPS

1. INDUSTRIAL COMPOSTING FACILITIES FOR ECO COMPOST PRODUCTION
2. PREPARATION OF ORGANIC BIODEGRADABLE WASTE FOR COMPOSTING
3. FURROW FORMATION FOR THE OPTIMAL COMPOST PRODUCTION PROCEDURE
4. BIOREACTOR TURNING AND ADDITION OF BIOACTIVENTS AND OXYGEN
5. CONTROL OF OPTIMAL HUMIDITY IN COMPOST PRODUCTION
6. WATER PREPARATION IN RAINWATER AERATION POOLS
7. CONTROL OF THE TEMPERATURE OF THE BIOLOGICAL REACTION OF COMPOST
8. COMPOST PACKAGING AND ENRICHMENT WITH MINERAL FERTILIZERS

BIOREACTOR COMPOSTING OF BIODEGRADABLE WASTE BY ADDING BIOACTIVENTS

TEHNIX'S PARTNER

eurovix
BIOTECHNOLOGY FOR LIFE

MEASURING AND TESTING DEVICES FOR ADDITION OF BIOACTIVENTS FOR THE PRODUCTION OF ECO COMPOST IN CONTROLLED CONDITIONS

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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NOTES:

AEROBIC SYSTEM

CONTROL AND MANAGEMENT CONTAINER
WITH EQUIPMENT

AEROBIC SYSTEM for the preparation of rainfall pool water. The plant is equipped with aerators - air dispensers. A special dispenser of bioactive agents that are activated in aerobic pools should be part in the system. It is necessary to turn the housing container as an office in which the equipment for water preparation with oxygen for dosing bioactive substances will be located. The special container must have special equipment, appropriate electrical installation, connected pipelines for reciprocating compressors, pipe installations and a control table for the operation of the plant. The container must be insulated, equipped with a living system and electronic informatics. Such a system is directly connected to a 150 m^2 pool, which is used to collect roof and surface water. The pumps for filling the composter with water have rubber pipelines which quickly dose the 1000 liter tank. It is necessary to equip the aerobic pool with an overflow system and a system for replenishing water from the public system. By building an aerobic system for the preparation of rainwater, we are completing a new technological unit that enables eco-composting of biodegradable and organic waste, and it is returned to green production. With such a complete technology we can achieve a circular economy process.

NOTES:

OLD FURNITURE RECYCLING PLANT

PLANT FOR RECYCLING OF OLD FURNITURE and other solid waste, for composting, shredding, crushing of solid organic waste for the production of eco-compost, is conceived as a modern special purpose product for shredding and crushing of solid wood and organic waste in the technological process of composting. The machine functions as an independent technological unit and is intended for work in a covered space, i.e. in conditions when the weather conditions are favorable (no precipitation). It is easy to carry and suitable for accommodate in different locations. Material (old furniture, doors, windows, ...) that is intended for recycling must be chopped or broken into smaller pieces, and then included in the process of bioreactor composting. The operation and management of the device should be very simple, which reduces the possibility of failure and damage to parts, and the device itself must be functional and economical. Shredding is performed by rotary knives made of special steel mounted on two hexagonal shafts. The device is powered by a 15 kW electric motor. Power from the electric motor is transmitted to the primary shaft by a planetary gearbox.

By turning the knives, the solid and organic waste is cut/shredded into a fraction up to approximately 30 mm thick and falls on the outlet conveyor, which takes it to a container with a volume of up to 7 m^3. The device is controlled via an electrical control cabinet with ergonomically arranged control controls. The intended dimensions of the housing with rotating blades are 1100 mm long, 725 mm wide, and 500 mm high with 33 sets of blades. The capacity of the device is up to 4 m^3/h of solid organic waste. Suitable for heat production.

NOTES:

ECO COMPOSTER

LITTLE GIANT - GREAT IMPACT
CROATIAN PRODUCT FOR EVERYONE

ROTO ECO COMPOSTER TEHNIX 120/900 mm. It is a special machine for the preparation of biomass, wood and old billets that are in solid municipal waste. It has huge advantages over previously known solutions. Such a machine is mobile and represents a new technological unit. Thick branches Ø 20-120 mm, cut into shapes or beams by self-insertion, are chopped to a length of 10-25 mm, crushed with a fan system, thrown into special containers or bags for receiving biomass. The driving power is 60 kW, and the same driving machine is used as with the bio shredder. The construction of the ROTO ECO COMPOSTER must meet the technological goals that will enable the performance of the planned technological tasks. Particular emphasis will be placed on the safety of the machine. The goal is to make the whole machine mobile and able to pull, so that the planned operations can be performed with the composting plant in the open or in the covered space. The complete drive system should be via hydraulic motors so that there is no possibility of electric shock.

TECHNICAL CHARACTERISTICS = SIMPLICITY AND ECONOMY

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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NOTES:

PLANT FOR COMPOST DOSING AND PACKAGING IN BAGS

PLANT FOR DOSING AND PACKAGING			
TYPE	INSTALLED POWER	DOSAGE TRANSPORTER	FILLING CAPACITY
PAK-T50/1	4 kW	DIRECT DOSING	to 3 m^3 / h
PAK-T50/2	10 kW	(2500 + 4300) x 1200 - 40 °	to 5 m^3 / h

SEMI-AUTOMATIC BAG PACKING SYSTEM. Packaging is done in compost bags with a volume of up to 50 liters for sale and use in agriculture. The plant consists of a receiving angle chain conveyor, a receiving hatch with a double worm dispenser, measuring dispensers and an output chain conveyor with a device for sewing bags. The device enables fast and precise filling of bags of 50 liters.

TECHNICAL CHARACTERISTICS = SIMPLICITY AND FUNCTIONALITY

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

NOTES:

MOBILE DISPENSER

FARESIN = TEHNIX

MOBILE DISPENSER - FARESIN = TEHNIX				
TYPE	POWER	LIFTING HEIGHT	MAX. CAPACITY	ROTATING RADIUS
6.26 CLASSIC	52 kW	6000 mm	2600 kg	3250 mm
7.30C CLASSIC 75	75 kW	7000 mm	3000 kg	3870 mm
8.40 HLS 103	103 kW	8000 mm	4000 kg	4150 mm

MOBILE DISPENSER for manipulation of biodegradable waste and finished compost, reloading and dosing from finished compost furrows into a rotary sieve and from a rotary sieve to a plant for packing compost in bags. The machine is powered by a diesel engine and a fully automatic hydrostatic transmission with two mechanical gears and a double FNR Control system and a switch on the steering wheel or on the hydraulic control lever. The maximum speed is 40 km/h. A servo-controlled braking system is installed, automatically reducing the driving speed depending on the height of the raised telescope. The QUEEN CAB control cabin is manufactured according to ROPS-FOPS standards with a Multifunction display with diagnostics, air conditioning, ventilation and heating, as well as preparation for radio and LED work lights. Access to the cabin is provided by a double door with the possibility of opening the upper part. Hydraulic fast coupling.

ADDITIONAL EQUIPMENT:

1. Special loading basket for light materials capacity 1,5 m^3
2. Special loading basket with branch grab capacity 2 m^3
3. 3. Fork carriage with forks for cargo transfer

TECHNOLOGICAL CHARACTERISTICS; FAST, AGILE, ECONOMICAL

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

NOTES:

Tehnix®
ECO INDUSTRY

COMPOST SIEVE TYPE TEHNIX

FOR CLEANING AND SIFTING COMPOST

COMPOST SIEVE - TYPE TEHNIX FOR CLEANING AND SIFTING COMPOST				
TIPE	SNAGA	PROMJER SITA	DUŽINA SITA	PERFORACIJA SITA GRUBO / FINO
KS-2000/45	45 kW	1920 mm	2000 mm	☐ 25x35 / ☐ 10x25
KS-3000/60	73 kW	1920 mm	3000 mm	☐ 25x35 / ☐ 10x25
KS-4000/73	105 kW	1920 mm	4000 mm	☐ 25x35 / ☐ 10x25

COMPOST SIEVE is a special mobile compost sieving machine with interchangeable rotary sieve for rough and fine sieving. The compost is sifted in a rotary sieve with a diameter of Ø1920 mm with sieving holes for rough fraction ☐ 25x35 mm and fine fraction ☐ 10x25 mm. The compost sieve is a compact device for efficient sifting of compost with diesel engines 45 kW/73 kW/105 kW that drive a multistage hydraulic pump. The machine has a receiving chamber with a dosing conveyor and a built-in hydraulic positioning system. A 500 mm step spiral is placed along the inner circumference of the rotary sieve in order to sift the material as well as possible and at the same time transport it towards the outlet of the rotary sieve. The sifted compost falls under the sieve on the longitudinal conveyor belt and the coarse unscrewed fraction is applied with the transverse screw conveyor to the separated pile. The rotation speed of the sieve can be regulated in the range of 5 - 15 revolutions per minute. In the upper part of the machine construction along the rotary screen, a steel brush is installed to clean the outer rim of the rotary sieve with a tilt adjustment system. The speed of rotation depends on the degree of humidity and the quality of compost maturity.

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NOTES:

BIO FURROW MAKER

SPECIAL DEVICE FOR FURROWS ROTATING, ADDING OF BIOACTIVENTS, WATER AND OXYGEN

BIO FURROW MAKER - SPECIAL DEVICE FOR FURROWS ROTATING, ADDING OF BIOACTIVENTS, WATER AND OXYGEN					
TYPE	POWER	ROTOR DIAMETER	FURROW LENGTH	FURROW HEIGHT	BIOACUMULATOR VOLUME
BBT-2300/73	75 kW	400 mm	2300 mm	1000	700
BBT-2800/105	105 kW	400 mm	2800 mm	1250	1500
BBT-3500/160	160 kW	400 mm	3500 mm	1500	2000

SPECIAL BIO FURROW MAKER MACHINE for processing biomass forms a trapezoidal furrow, and by turning the rotor it aerates, moistens and enriches the biomass with bioactives. The dimensions of the furrows depend on the type and size of the machine. The machine has an independent drive using a diesel generator of 78 kW/105 kW/210 kW and a built-in system for additional humidification and enrichment of the compost pile-BIOACUMULATOR. The machine is operated by the operator using electro-hydraulic controls from a closed, glazed cab positioned at the top with side access. This position of the cab ensures a quality view of the working environment. The machine controls the decomposing process of the biodegradable mass and is very easy to use with minimal maintenance. During the rollover process, the machine makes a trapezoidal furrow as the most suitable form for processing bio-degradable mass. During the decomposing process, the air-water-soil ratio of the compost pile changes due to microbial decomposition and naturally occurring effects. In order to ensure regular and homogeneous conditions for the decomposing of the whole pile, it is also important to rotate and moisten the biomass regularly. As a result of rotating and moistening, the material loosens, allowing oxygen to penetrate. Microbial activity is once again stimulated, resulting in an increase in temperature. Due to the penetration of new oxygen into the pile, anaerobic zones and anaerobic processes and the stench are prevented. During the rotation the dry and wet zones of the piles are mixed and the moisture level is equalized. Rotating also ensures a higher degree of homogeneity and compost quality with repeated mixing and regular decomposing. Biomass floor cleaners are installed on the front.

NOTES:

COMPOST ROTO SHREDDER

ROTO SHREDDER - AUTOMATIC WITH THE DOSAGE				
TYPE	POWER	DIAMETER OF ROTOR	LENGTH	CONTROL
KRS-1000	105 kW	1000 mm	2500 mm	Remote
KRS-1100	160 kW	1000 mm	2500 mm	Remote
KRS-1200	210 kW	1200 mm	2500 mm	Remote

Such a unique machine has the basic function of good preparation of green mass or wood mass, branches, leaves, waste grass, everything that is obtained in a city through park maintenance, tree branches up to 120 mm thick and other large organic waste. The chopped waste prepared in this way is an excellent accumulator for mixing with food waste from municipal waste, thus creating a quality mixture for ideal compost production. The entire ROTO-SHREDDER machine is an independent technological permanent functional unit which, using a remote control with a radio connection, manages, dispenses and shreds green waste, which takes up a lot of space and poses a danger from fires and rodents. The machine simply and efficiently produces shredded biomass for quality compost. Diesel engines with a power of 105 kW/160 kW/210 kW are sufficient to start a special multi-stage high-pressure hydraulic pump that drives all the functions needed for dosing, shredding, transport of processed material. The machine is mobile and has all the technological functions for independent shredding operations and is equipped with an automatic dosing crane, interchangeable blades, a massive shredding rotor, a tracked undercarriage system, and a magnetic separator with a permanent magnet for extracting metal.

TECHNICAL CHARACTERISTICS = SMALL FUEL CONSUMPTION, HIGH EFFICIENCY

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

ECOLOGICAL, ECONOMIC AND SOCIAL ADVANTAGES OF BIOREACTOR COMPOSTING TECHNOLOGY

- There is no disposal of untreated biomass in landfills because it is expensive and unsustainable;
- No expensive landfills are built to dispose of biomass that creates odors;
- Drinking groundwater in unregulated landfills is not polluted;
- They do not need expensive devices for water purification from landfills;
- No unpleasant odors from covered bio composts;
- High-quality phosphate-enriched eco-fertilizer for agriculture is produced;
- Significantly reducing harmful emissions and climate change of the planet Earth;
- The goals of the circular economy in waste management are achieved.

The process of bioreactor composting does not produce unpleasant odors and is not harmful to the environment while respecting the composting technology in a covered and semi-opened system with special machines in controlled conditions, and the resulting product is class I compost enriched with phosphate!

BIOREACTOR COMPOSTING OF BIODEGRADABLE MUNICIPAL WASTE

IRI I - DEVELOPING PROJECT OF THE COMPANY TEHNIX AND PARTNER FKIT

03/2018 - 3/2021

BUSINESS AND PROFESSIONAL TEAM AT THE OPENING OF THE COMPOSTING SCHOOL FOR TRAINING OF COMPOSTING MANAGEMENT MANAGERS

The bioreactor composting process enables controlled quality preparation of biomass for composting. The technologically defined process of eco-compost production and the covered space of the eco-compost enable the controlled implementation of the bioreactor composting process, which means that in every technological phase of compost production we have controlled maturation processes without unpleasant odors. The company Tehnix together with experts from the Faculty of Chemical Engineering Zagreb and the Croatian Academy of Technical Sciences has developed, tested in practice and produces complete technology for bioreactor composting, thus guaranteeing that in the prescribed technological conditions, using the latest technology, with expert supervision and application of process technology, **procesS bioreactor composting does not produce unpleasant odors and is not harmful to the environment.**

The bioreactor composting plant consists of several consequent technological units:

1. BIO SHREDDER WITH DISPENSER CRANE type TEHNIX 3 types.
2. SPECIAL MACHINE KOMPOSTDER for furrow rotating 3 types.
3. COMPOST ROTO SIEVE for sifting compost 3 types.
4. MOBILE DISPENSER for compost production, reloading and dosing 3 types.
5. SYSTEM FOR PACKAGING MATURE COMPOST IN 50 LITER BAGS 2 types.
6. AEROBIC SYSTEM for the preparation of rainwater pool water.
7. ROTO EKO KOMPOSTER TEHNIX 120/900 mm.
8. DEVICE FOR RECYCLING OLD FURNITURE, CAR TIRES and other solid waste.

Such a functional unit is a technological improvement of the industrial composting process which, by developing machines and their integration, offers the functional integrity of the technological solution because complete machine processing is enabled - from delivery of municipal waste to organic by-product, by improving technological processes, a fully acceptable biological processing of waste of organic origin is developed (controlled biological-aerobic conditions), the production cycle was shortened from 180 days to 60 days, production resources were rationalized, reduction of production costs, reduction of required production space, recycling and reuse of production resources (technological and rainwater), and the technological solution is closer to the target concept of “zero waste rate”/”zero rate of harmful emissions” (increased share of recycled biodegradable municipal waste, composting process that takes place in controlled conditions through the development of recycling systems and technical and rainwater collection). As a result of the project, the quality of the secondary product - eco compost - has been improved with the possibility of application in agriculture and environmental management (production of energy crops and remediation of devastated terrains).

The invention relates to a substantially improved technological process which shortens the production of compost from 6 to 2 months, and increases the quality of the obtained eco compost which, enriched with phosphate, enriches the fertility of the soil and enables the production of healthy food. The technological process has been improved by installing a tank for receiving clean water enriched with oxygen and active bioactive agents from rainwater from the roof of the hall into the reception pool of the indoor hall. On a special machine for rotating furrows, an operational secondary tank of 1 to 2 m^3 is installed on the furrow rotating machine, depending on the capacity of the composting plant, and the dimensions and length of the rotating furrows. There are two diffusers in the tank for water aeration, to which active bioactive agents developed in specialized laboratories for compost production are added at the beginning of composting. With a low-pressure compressor, we add air to the tank and by pushing it on the surface of the water we create a pressure of up to 0.3 bar, which allows us to inject water enriched with oxygen and bioactive agents into the space where the furrows are mixed and aerated.

In such a mixing process we perform several important operations that speed up the process of eco-compost production, even and comprehensive addition of bioactives to biomass where there are two nozzles arranged at an angle of 45 °C so that by turning the rotor and blades on the rotor we insert air into the furrows, we add active bioactives, we distribute them evenly over the surface of the prepared comminuted biomass by the crushing process, so that the bioactives enter the depth of the crushed biomass. This enables fast and intensive bioreaction of eco-compost production in controlled conditions in covered and ventilated spaces where fast maturation of compost mass takes place, which is heated with bioactives to a temperature of 70 °C, when rotating subcooling and maturing biomass takes place in 6 weeks. and two weeks remain for maturing, subcooling, sifting, cleaning and packaging of eco compost.

Such a process of bioreactor composting with the development of new technology has huge ecological, economic and social advantages from the hitherto known and used technologies in the production of eco-compost:

1. We are implementing the policy of the green plan of the EU and the Republic of Croatia
2. We do not dispose of untreated biomass in landfills because it is expensive and pollutes the environment;
3. We do not build expensive landfills to dispose of biomass that creates odors;
4. We do not pollute groundwater in unregulated landfills;
5. We do not need expensive devices for purifying water from landfills;
6. No unpleasant odors from covered eco-composts;
7. **We produce quality eco-fertilizers enriched in minerals;**
8. We produce healthy food for healthy human life;
9. We significantly reduce harmful emissions and climate change of the planet Earth;
10. We achieve the goals of the circular economy, sustainable development and goals of the green plan of the Republic of Croatia and the EU.

The basic idea and scientific commitment initially seemed feasible and ecologically necessary given the harmfulness of the current way of disposing of a large amount of biowaste and space pollution and the negative impact on climate change and global warming. At the beginning of the implementation of the project, it seemed that it was not such an extensive and demanding project. By elaborating the necessary innovative technological needs, we have determined that innovative ideas should be turned into real, technologically easily feasible, operational processes that will, in the shortest possible time, at the lowest possible cost, turn ideas into technological reality feasible in practice. A good working atmosphere, explosive motivation of all participants in the project, gradually starting from consulting meetings to the initial production results of individual machines, gave additional impetus to achieving operational units by exploring technological solutions that can meet the set goals.

We jointly determined that the technological processing must be carried out in controlled conditions, which meant that we need to design standard assembly projects that have all construction and spatial conditions, in which biological-technological processes can be developed, using all prescribed standards to achieve fast and quality production of biodegradable waste and in a period of 6-8 weeks we turn it into a quality eco-fertilizer to achieve soil enrichment for the new agro cycle. In the middle phase of achievement and development of technology, we found that we are going in the right direction because we determined using laboratory analysis that the resulting product, **eco compost**, has great mineral values in healthy food production, especially due to returning PHOSPHORUS, NITRATE AND CALCIUM to a new cycle of eco production.

Encouraged by the initial positive results, we increased our motivation in seeking operational solutions with which we can achieve operational and technological results. We have achieved the greatest technological progress through discussions in the development of individual machines and their working capacities with less energy and time, and lower costs in the development of new technology that will make investing in eco composting economically viable, environmentally sustainable and socially advanced.

Our goals were ambitious, but individually unattainable. By financing such a significant development project, using the funds from the Republic of Croatia and the European Commission, we have achieved global goals of enormous value, through which we will significantly contribute to the sustainability of the planet Earth. In creating the EU's green plan, the European Commission emphasized the fact that **caring for healthy soil is caring for life**, so soil is a resource that we must protect from pollution, enrich it with factory-produced fertilizers, at the lowest possible costs, using as little as possible in production. energy and time, creating new jobs, conserving drinking water as a significant non-renewable resource. The most important thing is to produce healthy food on healthy soil. Now that we have no answer to the question of pandemics, which are the greatest evil of the present, and caused by climate change, we try with great joy to justify the joint efforts of all participants in this project that we think and believe is part of the common good of all people on Earth, which is our common home.

THROUGH KNOWLEDGE WITHOUT LANDFILLS TO A SUSTAINABLE FUTURE

Tehnix, together with its partner, the Faculty of Chemical Engineering and Technology, University of Zagreb, and experts from the Croatian Academy of Technical Sciences and leading experts from vocational faculties, undertook a project commitment using EU funds to improve the composting system of biodegradable waste as a significant polluter of the environment. The draft contract on the development of a new technology of bioreactor composting was signed on March 12, 2018. Such professional development commitment gave creative freedom and great responsibility to turn theoretical knowledge into modern necessary practice, which will significantly improve the current manufacturing method of production and use of biodegradable waste, which means that most biodegradable waste is disposed of in unregulated landfills or later in expensive arranged landfills.

ONLY 8 WEEKS

CIRCUAL ECONOMY

Expert team for the development of TEHNIX plant for bioreactor composting of biodegradable municipal waste

OUR GOAL IS A CLEAN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT
TEHNIX d.o.o., www.tehnix.com, tehnix@tehnix.com, +385 40 650 100

Dear partners and associates in compost production!

For more than 30 years, we have been known in the market as a reliable manufacturer of utility equipment. On the following pages, we would like to present you the INNOVATIVE TEHNIX TECHNOLOGY OF COMPOSTING AND ECO COMPOST PRODUCTION FROM BIOREACTORS. We hope that you will find the necessary information in this manual, and we also invite you to work together in the future to contribute together to the sustainability of planet Earth, our common home.

Đuro Horvat, President of Tehnix,
creator of the bioreactor composting project
Croatian Academy of Technical Sciences
Faculty of Chemical Engineering and Technology

PATENT BR. D20210011
PATENT BR. D20210012
PATENT BR. D20210013

INTRODUCTION

Composting is one of the oldest methods of recycling. About 2000 years ago, the Roman scholar and author Columella, described in his agricultural reference book, how to mix different types of waste, put them in piles and how to reuse the material to improve the quality of the soil. There are also indications that organic waste was already methodically composted and turned into fertilizer in China more than 3,000 years ago. The Romans coined the name “compost” (Italian composite), from which the current name compost derives. The benefits of this natural, biological process for bio-waste processing have been forgotten for a long time. There is a growing awareness of environmental protection, which results in laws and increased costs of proper waste disposal, which means that composting has experienced a resurgence in many countries in the middle of the last century as a sensitive method of waste disposal. The rapid growth of composting to one of the most widespread methods of organic waste treatment began in the early 1970s. In the Republic of Croatia, composting is at the beginning. The most commonly used method is the method of composting into piles or furrows in the open. Organic waste from various sources is mixed, placed in furrows and then decomposed by dosing bioactive agents in controlled aerobic biological processes. The final product, compost enriched with nutrients and spread over surface that require fertilization, therefore completing the natural cycle of healthy food production.

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CONTENT

Tehnix®

ECO INDUSTRY

TECHNOLOGICAL MANUAL FOR BIOREACTOR COMPOSTING IN CONTROLLED CONDITIONS INNOVATIVE TEHNIX TECHNOLOGY

TEHNIX IS YOUR PARTNER IN CONSULTING, DESIGNING, PRODUCTION AND CUSTOMER TRAINING FOR THE PRODUCTION OF ECO COMPOSTING

Europska unija
Zajedno do fondova EU

REPUBLIKA HRVATSKA
Ministarstvo regionalnoga razvoja i fondova Europske unije

EUROPSKI STRUKTURNI I INVESTICIJSKI FONDOVI

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