

# HotRot - Environmental Discharges

## Odour Discharge to Air

All process air within the HotRot composting system is captured and processed through a biofilter.

Each HotRot vessel is sealed with removable insulated lids. Feed chutes are either sealed or directed to the feed augers. Each HotRot unit is fitted with an independent exhaust air fan with a volumetric capacity greater than that of the injection system; thus ensuring the HotRot vessel can be maintained under slight negative pressure. Air exhaust fans operate via a variable frequency drive and will automatically accelerate whenever the main shaft rotates and material is agitated resulting in increased vapour and odour discharge. Despite exhaust fans operating via a variable speed drive all biofilters are sized for maximum airflow thus ensuring efficient odour removal.

Each exhaust fan is mounted as near as practical to the biofilter this ensures all pipe-work is under negative pressure such that if a break occurs fresh air would be drawn into the system rather than odorous air being able to escape.

An independent consultant's study was undertaken to determine odour emission rates, using olfactometry, of a HotRot composting plant processing food and garden waste. The following table summarises the results of that testing. Odour emissions are reported as mean odour flux or the concentration of odour for each square meter of surface area of the sample tested. Reporting in this way allows this data to be extrapolated to any sized facility for odour modelling purposes.

Source	Odour concentration (OU <sub>c</sub> /m <sup>3</sup> )	Mean Odour flux (OU <sub>c</sub> /m <sup>2</sup> /s)	Offensiveness Rating	Odour Character
Untreated air prior to Biofilter	15,660	n/a	1.3	Rotting grass/muddy
Treated air discharged from Biofilter	565	6.34	0.2	No smell/cleaner smell
Compost immediately after discharge from HotRot units	150	0.17	0.3	Mouldy/musty/wet ground
Compost in storage piles (unturned, ready for distribution)	12	0.01	n/a	No smell

OU<sub>c</sub> = odour unit, certainty

## Odour Offensiveness Scale

Response	Numeric scale
Not annoying	0
Slightly annoying	1
Annoying	2
Very annoying	4
Extremely annoying	8

From the first table it can be seen that the standard biofilter designed to accompany a HotRot composting facility should achieve in excess of 96% efficiency and that all odours from a facility have a very low offensiveness rating.

## Condensate Liquor

Air that is exhausted from the HotRot composting vessels is warm and saturated by moisture. This air cools within the air exhaust ducts resulting in some condensation. Condensed liquor must be drained from the exhaust system and may be discharged to sewer or, where permitted, can be used for on-site irrigation or for keeping storage piles moist for dust control. The following table summarises results from two independent samples of condensate liquor. These results are indicative only and exact make-up will vary according to the type of material being composted and the efficiency of the composting process.

Analysis	Units	Sample 1	Sample 2	Limits of detection
pH		8.4	8.2	0.1
Total Suspended Solids	mg/l	12	7	3
Total Solids	mg/l	47	43	10
Total Ammoniacal-N	mg/l	240	220	0.01
Total Nitrate/Nitrite	mg/l	0.007	0.01	0.002
Nitrate-N	mg/l	0.003	0.003	0.002
Nitrite-N	mg/l	0.003	0.008	0.002
Total Phosphorus	mg/l	0.104	0.104	0.004
Carbonaceous BOD	mg O <sub>2</sub> /l	271	235	1
Chemical Oxygen Demand (COD)	mg O <sub>2</sub> /l	390	417	40
Electrical Conductivity	mS/m	321	296	0.1
Total Calcium	mg/l	0.7	0.5	0.05
Total Magnesium	mg/l	0.07	0.06	0.02
Total Sodium	mg/l	0.08	0.04	0.02
Sodium Adsorption Ratio (SAR)		<0.2	<0.2	0.2
Total Potassium	mg/l	0.3	0.1	0.05
Chloride	mg/l	2.9	2.5	0.5
Total Boron	mg/l	<0.01	<0.01	0.005

Analyses conducted by Hills Laboratories, Hamilton, New Zealand – test reports available on request.

The above analysis indicates that the condensate liquor should meet acceptance criteria for discharge to sewer or for irrigation, although the requirements of local regulations should be confirmed.

## Noise

The HotRot in-vessel composting system is designed to minimise noise levels. In general, the operation of loaders and delivery vehicles will produce more noise than the HotRot units and exhaust air system.

Measurements taken around a typical HotRot composting system are summarised below:

Noise at 1.5m from HotRot unit main drive:	60dB
Noise ½-way along unit with injector fan running:	75dB
Area around product discharge augers:	70dB
Area adjacent (at 1.5m) to exhaust fans:	68-78dB
Area adjacent (at 1.5m) to shredder:	80-85dB

Noise levels around the HotRot system are modest and do not require operators to wear noise protection. Noise levels adjacent to a shredder may be significant but these are typically contained within a waste reception building. Where the plant is located on a highly noise-sensitive site, acoustic hoods can be fitted over exhaust fans and injector blowers.

## Compost Quality

Obviously the quality of the compost will vary greatly depending on what is being composted; food, green waste, sewage sludge, etc. The following table provides some indicative values based on samples of compost taken at various HotRot composting facilities worldwide.

**Indicative Analytical Results of Compost**

Analysis	Units	Typical results (average)	Standards Limits
<b>Pathogens</b>			
<i>Salmonella</i>	MPN/25g	Not detected	Not detected
Total coliforms	MPN/g	<100 (25)	<200
Faecal coliforms	MPN/g	<50 (9)	<200
<b>Maturity</b>			
Dewar flask	°C	<5.0	<8.0
CO <sub>2</sub> evolution	mgCO <sub>2</sub> /gOM/d	<4.0	<16.0
Weeds		0	0
Plant germination	%	95	>80
Plant top growth	%	95-105	>80
<b>Chemical Analysis</b>			
pH		7.0-8.5 (7.8)	5.0-8.5
Conductivity	mS/cm	<50 (38)	
Total carbon (TOC)	%	49.5 (45-55)	
Total nitrogen (TKN)	%	2.1 (1.5-3.0)	
Carbon:nitrogen ratio	:1	23.5 (18-30)	≤25
Total phosphorus	mg/kg dry	2,700	
Total potassium	mg/kg dry	3,825	
Moisture content	%	25-50 (35)	
Bulk density	kg/m <sup>3</sup>	250-350	

<b>Trace elements</b>			
Cadmium	mg/kg dry	0-0.45 (0.17)	0.7
Chromium	mg/kg dry	12-26 (19.4)	100
Copper	mg/kg dry	12-35 (20.3)	100
Nickel	mg/kg dry	4.0-7.0 (6.0)	50
Lead	mg/kg dry	5.0-15.0 (9.7)	200
Zinc	mg/kg dry	60-130 (85)	400
Iron	mg/kg dry	14-22,000 (17,600)	3-30,000
Sodium	mg/kg dry	1-4,800 (3,500)	1-10,000
Boron	mg/kg dry	45-60 (53)	
Manganese	mg/kg dry	250-350 (300)	
Molybdenum	mg/kg dry	1.5-2.5 (1.8)	
Mercury	mg/kg dry	0.15-0.18 (0.16)	1.0

It can generally be expected that compost produced by the HotRot system will meet international standards for pathogen elimination and maturity. Where compost is produced from source separated garden and kitchen waste levels of trace elements and contaminants should also meet international standards. Where compost is produced from sludge from sewage treatment heavy metals may be elevated and testing of product is recommended.