

# A small scale bioreactor for solid state process development



- Provides thorough mixing of soils, organic wastes, natural and contaminated solid substrates, etc.
- Allows rapid evaluation of microbes, biodegradation, etc.
- Allows rapid optimization of process parameters
- Flexible, expandable DDC control unit
- Links to data-logging and control software
- Easy access for introduction and removal of material
- Compact and robust

## What does the Terrafors do?

The Terrafors is a special development between INFORS and MADEP over a number of years to create a safe, efficient way of performing process development studies for biodegradation, bioremediation and solid state fermentation. It allows for the creation of a precisely controlled environment which can be used for selection and cultivation of specialized communities of microbes appropriate to specific applications involving the treatment of solid and semi-solid waste and contaminated soils. These include bacteria, yeast and fungi with aerobic, micro-aerophilic and anaerobic requirements across a range of temperatures.

### Base Unit

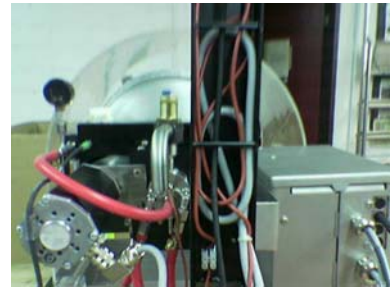
This consists of a sturdy support frame for the vessel with a water circulation system, gas supply rotameter and powerful drive motor. A compact housing contains the electronics and provides a mounting for peristaltic pumps. A tray beneath and a transparent safety shield ensure safe handling when in operation.

### Vessel:

The stainless steel vessel can be raised and lowered with a simple lever system and the entire top section removed for easy access. Ports are provided in the lid for eg. liquid sampling. In the horizontal position, the vessel is rotated by a powerful motor to provide mixing. Capacity is 15L total volume.

### Instrumentation & Software

Control is provided by a universal version of the proven X-DDC controller used in the LABFORS range of fermenters. This is a flexible system with potential for expansion and addition of external sensor systems eg. gas analysis. A serial link allows data-logging and sophisticated control strategies via our standard IRIS SSPC software.



## What is it for?

Process development and screening at bench-scale involving:

- Waste water treatment
- Bioremediation of soils in landfill etc
- Decontamination/recycling of solid/semi-solid waste products
- Composting and anaerobic digestion
- Environmental management projects
- Solid state fermentation process development

## Advantages of Solid State Fermenters: (compared to submerge cultures in a fermenter)

- Higher productivity of enzymes (up to x10)
- Usually simpler with lower energy requirements
- May be easier to meet aeration requirements
- Higher yields in a short time eg enzyme production
- Resembles the natural habitat of filamentous fungi
- Less effort required for downstream processing



## Hardware Specifications:

<b>Reactor Type</b>	Rotating Drum
<b>Dimensions &amp; Weight</b>	l x b x w
<b>Volume</b>	15 l
<b>Material</b>	Steel grade 1.4435/A4 (acid and base resistant)
<b>Aeration</b>	0.04 to 25 NI/min (0.16 to 100 vessel volumes/hour)
<b>Aeration regulation</b>	Rotameter and automatic On/Off control of inlet/ exhaust gas valve
<b>Gas diffusion</b>	Steel sparger (1 mm diameter holes) Option: porous plastic tube (fine bubbles)
<b>Temperature regulation</b>	Water jacket. Range: ~5 degrees above coolant to 99 C
<b>Useful pressure range</b>	Atmospheric up to 0.5 bar overpressure
<b>Agitation</b>	0.1 to 10 rpm, programmable speed, direction and duration. Movable baffles mounted on the inner wall
<b>External liquid feed</b>	Peristaltic pump for addition of water, acid, base, anti-foam, etc.
<b>Access ports</b>	2 ports. 20 mm diameter. Septum for liquid or air sampling
<b>Sampling Tube</b>	For liquid sampling, substrate addition or product removal
<b>Temperature</b>	Pt-100 temperature sensor
<b>Exhaust gas O<sub>2</sub></b>	0.1 to 95%. Oxygen partial pressure measurement using a zirconium cell
<b>Exhaust gas CO<sub>2</sub></b>	0 to 10%, Spectrometric absorption method
<b>Automatic data logging</b>	A feature of IRIS software
<b>Off-line Analysis Data</b>	IRIS accepts and displays results that are not received in real time

*Additional equipment to measure CH<sub>4</sub>, NH<sub>3</sub>, pH, conductivity, ORP, RH, etc are easily integrated with the process control software.*

## Applications Examples:

FIELD OF APPLICATION	TYPES OF POTENTIAL USE	CLIENTS
Biodegradation studies and method development	<ul style="list-style-type: none"> <li>- Composting process development</li> <li>- Anaerobic process development</li> <li>- Treatment of solid wastes (e.g. coffee grounds)</li> <li>- Treatment of semi-solid wastes (eg. Municipal sludges)</li> <li>- Treatment of liquid wastes (e.g. leachates)</li> <li>- Determination of microbial kinetic coefficients</li> <li>- Optimization of physical and chemical process parameters</li> </ul>	<ul style="list-style-type: none"> <li>- Biowaste treatment centres.</li> <li>- Environmental Engineering Departments</li> <li>- R&amp;D laboratories</li> </ul>
Bioremediation studies and method development	<ul style="list-style-type: none"> <li>- Simulation of on-site conditions using soil samples from the client's site</li> <li>- Soil priming with pollutant-degrading microorganisms</li> <li>- Determination of microbial kinetic coefficients</li> <li>- Optimization of physical and chemical process parameters</li> </ul>	<ul style="list-style-type: none"> <li>- University</li> <li>- Environmental Engineering Departments</li> <li>- Bioremediation service</li> </ul>
Bioprocessing studies and method development	<ul style="list-style-type: none"> <li>- Enzyme production on solid substrates</li> <li>- Fungal fermentations (citric acid production for example)</li> <li>- Protein enriched animal feed production</li> <li>- Single cell protein production</li> <li>- Mycotoxin production</li> <li>- Bio-pulping</li> <li>- Study of extremophiles</li> <li>- Production of antibiotics, alkaloids, plant growth factors, organic acids, surfactants, aroma compounds</li> </ul>	<ul style="list-style-type: none"> <li>- Food processing industry</li> <li>- Animal feed suppliers</li> <li>- Bio-pesticide producers</li> <li>- Cheese making industry (spore production)</li> <li>- Paper industry</li> </ul>
Fundamental and applied soil ecology	<ul style="list-style-type: none"> <li>- Microbial ecology</li> <li>- Phytopathology,</li> <li>- Biological pest control</li> <li>- Chemical pest control</li> </ul>	<ul style="list-style-type: none"> <li>- Agricultural research s</li> <li>- Agrochemical industry</li> <li>- R&amp;D laboratories</li> </ul>

## INFORS, your partner for Research & Development



Minitron



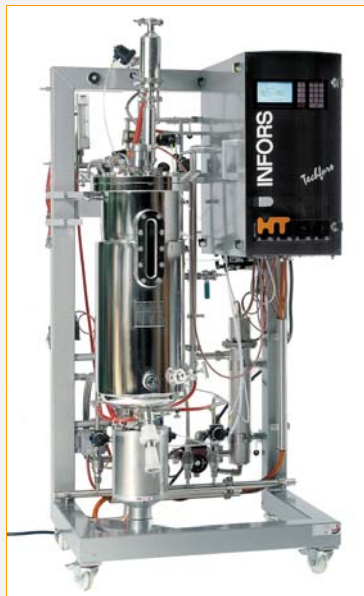
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Techfors-S



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TF 600 Produktionsanlage

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