RHINO®
AGITATOR DRYERS
Made in Germany

Ideal for drying liquid manure, fermentation residue, sewage sludge and industrial biomass.
With the emergence of biogas plants at the start of the 1990s, farmers were confronted with the need to cost-effectively and usefully dispose of fermentation residue, whether liquid or solid residue, produced by the fermentation of biomass. The operators of sewage treatment plants have faced this challenge for some time, as they were unable to store increasing volumes of sewage sludge for long periods of time on their land.

Due to the high content of NPK (nitrogen, phosphorus, potassium) substances in this wet residue, it was obvious that these substrates could be used as first-class fertilizer on farmland. As sewage sludge often contains pollutants, this method of disposal is now legally prohibited.

When that's the solution...
The material to be dried is fed to the dryer in a liquid or solid consistency. The integral scale underneath the drying tank and a fill level sensor monitor the fill level in the dryer. Two horizontal agitators operate in the drying tank, rotating slowly counterclockwise (2-4 revolutions per minute) and continuously mixing the material being dried. Fresh air is drawn in by the supply air fan and then forced through the heat exchanger. An external heat source feeds the heat exchanger with hot water.

The air, thus heated, is blown through the air duct and through the slotted tray (see illustration on next page) into the material to be dried. This slotted tray at the bottom of the drying tank is equipped with an automatic cleaning mechanism. The slotted tray guarantees the low-resistance supply of the drying air into the material being dried. By continuously mixing the material to be dried, the drying air can gently flow through the material, at the same time contacting a large surface area, which effectively transfers moisture to the drying air.

The maximum volume in the drying tank is attained when the fill level reaches the agitator shafts. Once this maximum fill level has been reached and the material being dried has attained the pre-set degree of drying, a third of this maximum fill level is discharged. Two thirds remain as the base volume in the drying tank. Small amounts of fresh material, still to be dried, are gradually added to this dried base volume of material. The fill level thus increases again to its maximum fill level. Constant mixing with the addition of fresh material to be dried produces a homogeneous mass that does not stick.

The drying process is therefore continuous, while the discharge of material is discontinuous.

**THE SOLUTION:**

**AGITATED DRYING**

**RHINO AGITATOR DRYERS**

LOW-WEAR.

DURABLE.

That's great!...what does the machine look like?
THE PRODUCT

Agitator drives
Drying tank, here 7 m long
Air intake filter with upstream fan
Heat exchanger
Agitators
Slotted tray with cleaning mechanism
Hot air duct
Exhaust air pipe
Filter bags with vibration mechanism for automatic cleaning
Feed for biomass, solid or liquid (e.g. liquid manure, fermentation residue, sewage sludge etc.)
Discharge screw
Agitator drives

I like it!

Made in Germany

THE PRODUCT

I like it!

Made in Germany
The exhaust air is continuously cleaned through a dust filter system fitted to the drying tank. The dust and odours bound to it remain “suspended” on the filter hoses, forming what is known as filter cake. This filter cake grows during the drying process, increasing the air resistance and raising the back pressure within the drying tank. Automatic filter cleaning is triggered as soon as this back pressure reaches a defined threshold. This involves briefly lowering the performance of the fan and vibrating the filter hoses. The filter cake then drops back into the drying tank and is mixed here with the material that is still moist.

The exhaust air scrubbed by the filter hoses and laden with water is discharged into the environment through the exhaust air chamber and exhaust air pipe. The fibre length of the material to be dried may not exceed 5 cm to ensure the effectiveness of the filter hoses.

The dried material is discharged out of the drying tank once the upper fill level and the specified degree of drying have been reached. The degree of drying is determined by a humidity sensor and can be set at between 70% and 100% dry matter (DM) content. The fill levels are monitored using the integrated scale in conjunction with the fill level sensors.

The agitators continuously blend and mix the material, with their conveying elements (paddles) simultaneously ensuring horizontal circulation of the material to be dried in the drying tank, and thus homogeneous dried material.

This functionality ensures that the fill level is kept at a certain level along the entire tank, with the result that a discharge screw fitted at the front end is enough to empty the drying tank. The discharge process continues until the tank contains material with the pre-set residual moisture level or the minimum fill level has been reached.
CONTROL TECHNOLOGY

The complex control of the drying process is displayed in an easily understandable and user-friendly manner, thanks to the innovative software and visualisation. The hardware consists of standard industrial components with a long-term availability of spare parts.

All process data is registered and recorded continuously. All key functions can be analysed and correspondingly optimised using graphs. The control system guarantees efficient drying at all times.

THE RHINO PRODUCT RANGE

Our RHINO dryers come in five sizes and three versions.

- RHINO 2000
- RHINO 3000
- RHINO 5000
- RHINO 7000
- RHINO 10000

for the Agricultural, Municipal and Industrial sectors.

INSTALLATION AREA: HOW MUCH SPACE DOES A RHINO DRYER NEED?

Our drying machine always arrives on site well packaged - actually better than that - solidly incorporated in a conventional sea container measuring 12.20 m long, 2.50 m wide and 2.90 m high.

With a top-mounted filter system, the RHINO dryer has a height of 5.06 m, and with an exhaust air pipe this even rises to 12 m.

Our RHINO is therefore weatherproof and space-saving - installation outdoors is ideal. There is no need to construct an additional building to house it!

Our RHINOs first and foremost need the space to fit their respective dimensions (see table).

<table>
<thead>
<tr>
<th>Dimensions in m</th>
<th>Length</th>
<th>Width</th>
<th>Height*</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHINO 2000</td>
<td>12.20</td>
<td>2.50</td>
<td>5.06</td>
</tr>
<tr>
<td>RHINO 3000</td>
<td>12.20</td>
<td>2.50</td>
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<tr>
<td>RHINO 5000</td>
<td>12.20</td>
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<tr>
<td>RHINO 7000</td>
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</tr>
<tr>
<td>RHINO 10000</td>
<td>19.20</td>
<td>2.50</td>
<td>5.06</td>
</tr>
</tbody>
</table>

*(excluding exhaust air pipe)

NDM Natural Recycling Centre in Velen, hygienisation / fuel and phosphorus recovery from liquid manure (NRW)

Connections required on site:
- Power
- Internet (network)
- Water flow and return
- Dry substrate feed

Well, I’d like one of those!
An adjustable 20% sulfuric acid solution is added to the liquid manure and/or fermentation residue through a hose system. Sulfuric acid and ammonia have very high reactivity (affinity). The ammonia contained in the dry substrate combines in the exhaust air stream until the filter bags are fully filled with the instilled sulfuric acid to form ammonium sulfate. As the filter cake that forms on the filter bags is returned to the drying tank at regular intervals by automatic filter cleaning, all the nutrients of the dry substrate are retained in the discharged dried material. This produces a biological fertilizer without the production of an ammonium sulfate solution that requires an additional collection tank.

When drying sewage sludge, the exhaust air is scrubbed by a chemical exhaust air scrubber, in which the exhaust air flow is pressed through a wall of water acidified with sulfuric acid. This washes the ammonia out of the exhaust air and it is collected as ammonium sulfate solution in a downstream container. Apart from the occurrence of ammonia, authorities can also impose requirements governing the odours, depending on the location. In this case, the additional construction of a biofilter to comply with odour intensities seems likely.

"The first dryer that I really trust." (Biogas customer, 2016)

"Impressive: it runs just like it looks!" (Sewage sludge customer, 2017)
RHINO INDUSTRY

DIVERSE INDUSTRIAL BIOMASS CONSTITUTES ANOTHER DRYING SEGMENT.

The RHINO agitator dryer perfectly dries vegetable remains for the food industry and rejects from the paper industry. Compost and other remains to be treated. The machine to be constructed is always matched to the material to be dried and the customer’s requirements.

FROM RESIDE TO RAW MATERIAL

The dried biomass provides you with a biological fertilizer for use on fields and gardens, due to the ammonia being bound in the dryer when drying liquid manure and fermentation residue. If a chemical exhaust air scrubber is installed downstream, this produces ammonium sulfate solution as a mineral fertilizer. Dried sewage sludge can be incinerated with a higher calorific value.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>Heat consumption in kW*</th>
<th>Drying air volume in m³/h</th>
<th>Electrical energy consumption in kW**</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHINO 2 000</td>
<td>50-140</td>
<td>6 000</td>
<td>6</td>
</tr>
<tr>
<td>RHINO 3 000</td>
<td>130-220</td>
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<td>RHINO 5 000</td>
<td>125-350</td>
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<td>14</td>
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<tr>
<td>RHINO 7 000</td>
<td>175-490</td>
<td>21 000</td>
<td>18</td>
</tr>
<tr>
<td>RHINO 10 000</td>
<td>250-700</td>
<td>30 000</td>
<td>33</td>
</tr>
</tbody>
</table>

* depending on the DM content and the air permeability of the material to be dried, the water flow temperature, outside temperature and air humidity of the fresh air drawn in. ** in kW, excluding feed and discharge, multiplied by the respective number of hours of use.

Evaporation performance per kWh used

1.0 - 1.4 litres of water

RHINO CUSTOMER SERVICE

Sophisticated drying processes in durable capital equipment require monitoring, maintenance and - over time - repairs. We’re also there for you after the purchase of a drying system. As we are when you are planning to extend your system.

We recommend concluding a maintenance contract with us. RHINO Service will take care of your system – permanently and reliably. Apart from an annual inspection lasting 1 to 2 days, we also offer you remote maintenance in the form of online support using Teamviewer software. You can reach us on all working days.

(Industrial customer, 2018)
RHINO DRYING SYSTEMS –
A SUPERLATIVE IN DRYING TECHNOLOGY!

EFFICIENT
POWERFUL
FAST

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We have been building machines since 2009, and our RHINO dryers since 2013: agitating, enduring, with superior efficiency – always offering your business the opportunity for major profit.

Get in touch with us!

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Important note: Despite careful checking, we cannot accept liability for the information and statements made here.