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Drying of organic residuals in the Rolling Bed Dryer

Biofuels have a number of advantages over traditional fuels in economic, environmental and practical terms. They are often local, cutting down on transport costs and associated traffic emissions, achieve CO_2-neutral combustion at high temperatures and are suitable for automatic combustion if suitably processed. One obvious disadvantage of biofuels compared to traditional fuels is that they often need extensive drying to remove moisture before use. In this article, authors from Allgaier Process Technology describe their company's Rolling Bed Dryer, which satisfies the full 'wish-list' for drying organic residual materials for biofuel production.

Above: The production of biofuels benefits from an efficient drying process, such as that used by Allgaier Process Technology's Rolling Bed Dryer.

There are numerous examples of residual organic materials that can be made into biofuels via simple processing. These include the production of wooden pellets made of wood chips, manufacturing briquettes from waste wood, green garden waste and bark and processing rejected material from the waste-paper recycling process into fuels. Other common organic residues include the fermented substrate from the pulp of sugar beet, bagasse, plastic waste, straw and grass, pomace from fruit and grapes, used coffee grounds, straw and horse dung.

Many provide good levels of energy when burnt, although as can be seen from the table below, drying the material can double or even treble the apparent calorific value per kilogram of material.

Material	Energy (moist) (kJ/kg)	Energy (dried) (kJ/kg)
Wood and garden waste	6.30	14.65
Bagasse	9.20	18.40
Fermentation from domestic waste	16.70	18.90
Straw	10.05	10.50

Above: Energy contained in various biowastes when harvested (moist) and dried.

Drying organic residues

As described above, biofuels can be economically viable, environmentally-friendly and achieve high temperatures, they also have some inherent problems. Most of them are bulky and uneven, may have high levels of contamination, are sensitive to temperature and may emit volatile matter or exposive dust.

Organic residues also need to be dried before they can be used as biofuels. There are several types of dryer for this process, including drum dryers, fluidiser bed dryers and belt dryers. Each of these has different advantages and disadvantages.

Drum dryers are large and complex machines that run gas and solids in parallel. They are liable to emit fine material, are not easily accessible and have a low de-dusting effect.

Fluidised bed dryers have perpendicular gas and solid flows on a shallow bed. They enable the drying air to become saturated with moisture easily and retain the solid material for only a short time. They can form 'carpets' in the case of bulky and fibrous products such as tree cuttings, which can stick to internal parts. They also consume a large amount of energy.

Belt dryers also have perpendicular gas and solid flows, but a lack of solid mixing creates moisture layers. They can only be used for low-temperature drying and do not de-dust products. In common with drum dryers they are large and suffer expensive maintenance.

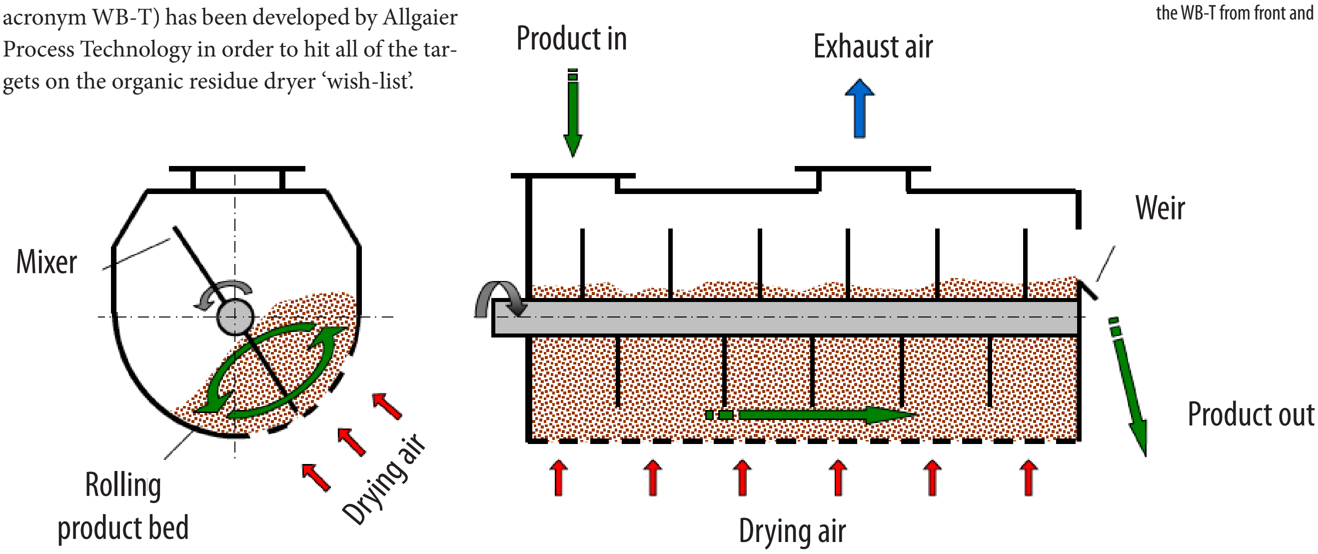
A 'wish-list' for organic residue dryers

Looking at the advantages and disadvantages of the various organic residue dryers, it is possible to draw up a 'wish-list' of the desired characteristics of such a dryer:

- Ability to process different wastes,
- Deep bed of bulk material,
- Long retention time,
- Good mixing of solids,
- Ability to be run on waste heat,
- Low air velocities,
- Low pressure drop,
- Low electrical energy consumption,
- Efficient de-dusting of product,
- Removal of impurities such as sand,
- Simple design in acceptable dimensions,
- Low weight of moving or rotating parts,
- Easy access for maintenance.

Concept – The Rolling Bed Dryer (WB-T)

The Roller Bed Dryer (known by its German acronym WB-T) has been developed by Allgaier Process Technology in order to hit all of the targets on the organic residue dryer 'wish-list'.



Below: Cross-sectional views of the WB-T from front and side.

The WB-T combines the advantages of drum dryers and fluidised-bed dryers and features gentle drying at low temperatures. High energy-efficiency, homogeneous and thorough drying of organic residues is achieved.

The WB-T has a compact bed of solid for optimum heat-exchange, low exhaust temperature and low heat loss. It makes effective use of low temperature exhaust air and has adjustable velocity of the drying air for processing of different types of waste. Low product temperatures lead to low emissions and pollution by total organic compounds. The simple yet-effective design leads to a long retention time and a very homogeneous drying of the product.

Test plant at Allgaier

To test the design of the WB-T, a 1m x 3m model plant was constructed at Allgaier's facility. Photographs of the machine in action can be seen below.

Far left: Drying tree cuttings and green garden waste in the test plant.

Far left: A test-size WB-T was developed at Allgaier.

Reference plant in the Netherlands

Allgaier supplied a 25t/hr WB-T plant with two identical WB-T's for green garden waste to a Topell Energy BV site in the Netherlands. The site is shown below.

Left: Bird's-eye view of the Topell Energy site, with twin WB-T's (grey) running left to right.

Processing of RDF in a WB-T

Refuse-derived fuel (RDF) can be produced from municipal waste, including plastics, in a WB-T. Tests carried out on a sample WB-T to assess optimum air velocities showed that wet input material with 42% residual moisture (unhomogeneous material) with a bulk density of 160kg/m^3 was converted to dry material with a residual moisture content of 4% and a bulk density of 99.5kg/m^3.

Conclusion

Allgaier's Rolling Bed Dryer solves many of the problems encountered by users of conventional organic-residue dryers.