SUCCESSION SUCCESSION

ASS



Engineered For Your Success

FROM MANURE TO VALUE

TABLE OF CONTENTS

| The Two Sides of Manure | page 02 |
|---------------------------------|---------|
| Efficient Processing of Manure | page 03 |
| Advantages of Manure Processing | page 04 |
| MoRoPlant20 | page 06 |
| The Flottweg Decanter | page 08 |
| Manure Processing in Detail | page 10 |
| Successful in the DLG Test | page 12 |
| Always in Good Hands | page 14 |
| Technical Data | page 16 |
| References | page 17 |



THE TWO SIDES OF MANURE

Manure is a precious substance since it contains important elements such as phosphor and nitrogen, which are essential nutrients for plant growth. This means that cattle and pig breeders have the possibility to contribute to a closed nutrient cycle with their so-called "waste product", thus creating surplus value for their company.

Manure, however, can also be a problem. Even in small breeding establishments and feed lots, big quantities of manure are generated. Storage alone is not easy since untreated manure is aggressive or even toxic. In order to avoid dangers such as suffocating or being drowned, operators have to stick to strict safety requirements. Moreover, there are considerable odor and fine dust emissions.

Manure in intense refinement regions is a special problem. Farmers either have to create huge storage capacities in order to bridge retention periods for the application of fertilizers or they have to transport their manure to other regions. Since manure is considered a hazardous material, there are further costs and additional emissions for and during transport.

It would be more environmentally friendly and economical to process manure directly on site and make use of it regionally. But how?

PROCESSING MANURE EFFICIENTLY

The Answer Lies in Processing

By processing manure using a decanter, it is separated into solids and process water. The target is to bind as much phosphor and nitrogen in the solids as possible. This way, farms recover natural fertilizers on the one hand, and on the other hand process water, which can be regionally spread onto the soil.

Until now, existing separation processes did not bind enough nutrients in the dry substance, so that their concentration in the remaining manure (the centrate) was still too high. Moreover, stationary separation systems are not cost-efficient for small farms.

MoRoPlant20, a new separation system for manure, offers an efficient and cost-saving solution. Thanks to a new conditioning process and the proven Flottweg centrifuge technology, the system achieves high separation efficiency for phosphor and nitrogen. Moreover, a mobile container system can be used by different farms, thus being also attractive for small farms, agricultural syndicates and suppliers of agricultural equipment. The most important effect is that the recovered dry substance can be sold as garden fertilizer or as fertilizer spread onto the soil.

Agricultural Challenges

Environment and groundwater protection are becoming increasingly important in the agricultural sector. Farms are looking for new processes that are environmentally friendly and cost-efficient at the same time. Manure processing makes sense due to the following developments:

Here are the five most important factors:

- The increasing quantity of manure (excess of organic fertilizer in regions with a high level of refining)
- Increasing requirements and costs for the storage and transport of manure
- Time and quantity limits for manure spreading, due to ever-increasing legal requirements

MANY BENEFITS

The mobile separation system MoRoPlant20 separates manure into solids and process water before storage in an energy and cost-efficient way. The following diagram provides an overview of the process.



Mobile Compact System

4

Unlike stationary manure processing systems, MoRoPlant20 is more flexible, more energy-efficient and more cost-efficient. Several companies can use the same mobile container system together. Processing of manure lakes is also a possible application for this container system.



Solids as Organic Fertilizer

The recovered solids are odorless and can thus be stored safely and easily, without safety data sheets. A special surplus value is generated because the solids can be pelletized and sold, for example as garden fertilizer or fertilizer to be spread for gardening firms and centers. Since the aggregates are completely degradable and in general harmless, it is also possible to market them as ecologic fertilizer compliant with the EC Organic Regulation.

Process Water to Be Spread out

The centrate is less aggressive and less toxic than the original manure, thus being considered as a reduced hazard. Therefore there are less stringent conditions for storage. Moreover, odor emissions, fine dust emissions and operating costs decrease. Transport costs are also reduced, since the centrate is no longer considered as a hazardous material. The process water can be used for irrigation, for example for hops or asparagus. It is also useful for irrigating legumes (five field cultivation), thus contributing to sustainable soil improvement. Due to its low dry matter content (< 1 %), plowing under the centrate is no longer necessary from an agricultural point of view.

Sustainability Thanks to a Nutrient Cycle

Processed manure can mostly be re-used locally thanks to nutrient classification. The starch additives used consist of different fruits cultivated on local fields. The bentonite used is a raw material which increases the fertility of the soil.

All the additives used therefore have a positive impact on the ecosystem, improving the soil in a sustainable way and constituting highly efficient natural fertilizers with a strong ability to generate top soil.

How MoRoPlant20 Works

.

The compact system is included in a standard container and is scalable in size. Before the separation process, a special conditioning agent consisting of bentonite and starch is added to the manure.

Separation takes place in a Flottweg Decanter of the Z series, specifically optimized for this agent. Thanks to this combination of **conditioning agent** and **high-performance decanter**, MoRoPlant20 achieves a considerable **dry matter content** with an efficiency of separation of the nutrients that has never been previously attained (for more details, please see page 13).





Moroplant20 Problem Material Processing

Innovative Flocculant

An efficient combination: The clay mineral mixture bentonite acts as natural separator. Due to its gluing properties, plant starch binds the solids contained in manure with the bentonite, thus generating a water-insoluble flake. This favors mechanical separation, improving separation efficiency. Mixing and managing of both additives are performed completely automatically. The components are fed to the manure via a tubing system before it is conveyed into the decanter.

Who benefits from MoRoPlant20?

- Pig and cattle breeders
- (small and medium-sized enterprises)
- Agricultural syndicates: farmers, contractors
 and machinery syndicates
- Equipment suppliers for large agricultural firms, for example providers of stable equipment

THE FLOTTWEG DECANTER

The heart of the processing system is the decanter centrifuge, which continuously separates the solids from the liquid. For MoRoPlant20, a high-performance decanter of the Flottweg Z series is used. This is a modular decanter and it is optimally adapted to be used in a container system.



Advantages of the Flottweg Decanter

- Optimal separation results particularly high separation efficiency of manure in combination with the additives bentonite and starch
- $\,\cdot\,\,$ Recovery of energy, thanks to the innovative bowl and scroll geometry
- Robust design consisting of high quality stainless steel "made in Germany"
- · Wear protection and maintenance-friendly design for minimum downtimes
- \cdot Easy operation and user-friendly control system via the Flottweg Touch Control
- \cdot Advice and support services throughout the entire process

More than 60 years of experience

Flottweg has been manufacturing decanter centrifuges since 1956. As a worldwide supplier of solutions for solid-liquid separation, Flottweg has been continuously developing decanter technology and exploring new applications. Our long-term experience in municipal and industrial sewage sludge processing is the optimum basis for finding the best solution for manure processing, too. Flottweg centrifuges stand for high efficiency, robustness and durability.





How the Decanter Centrifuge Works in Manure Processing

Thanks to its high centrifugal acceleration (approx. 2,500 – 5,000 rpm), the decanter efficiently separates the solids contained in manure from the liquid phase. Since the floating parts have a higher density, they are packed against the bowl wall. The conveyor scroll conveys the solids continuously to the discharge system. The liquid phase is discharged as process water along the scroll.



The bowl of the decanter centrifuge has a cylindrical/conical shape and rotates at high speed. It is precisely adapted to the mixture of manure and additives. The mixture rotates with the bowl at the operating speed and forms a concentric layer at the bowl wall. The solids contained in manure are packed against the bowl wall by centrifugal force.



The scroll rotates at a slightly different speed from the bowl and conveys the separated solids toward the conical end of the bowl. The differential speed determines the residence time of the solids in the bowl. Residence time is a critical factor for cake dryness after separation.



Settled solids are ejected through ports at the conical end of the bowl into the solids housing and fall through the discharge chute. Thanks to the additives previously introduced, and thanks to efficient separation technology, the dry matter substance contains almost the entire phosphor content contained in the manure.



The clarified process water flows to the cylindrical end of the bowl where it exits over weir plates. Easily adjustable weir plates allow for precise adjustment of the pond depth in the bowl. The liquid is then collected in a centrate chamber and discharged by gravity.

The product is fed through a stationary pipe into the feed zone located in the center of the scroll. The product is then accelerated circumferentially and delivered through distribution ports into the bowl.



Adjustable Impeller

The clarified process water can also be decanted via an impeller and discharged from the bowl under pressure. This eliminates the need for a separate chamber pump. The Flottweg adjustable impeller is an engineering refinement that permits quick and precise adjustment of the pond depth during operation, to accommodate changing process conditions without having to switch off the centrifuge.



Flottweg uses high-quality stainless steel for all product wetted areas. The standard bowl consists of high-strength Duplex steel casting, the scroll body consists of stainless steel casting.

SUCCESSFU

M

IN THE DLG TEST

The German Agriculture Association DLG has confirmed the excellent separation results of MoRoPlant20 in a complex field test. As a consequence, the separation system was awarded the quality mark "DLG approved" in gold.



Measurements were carried out in a pig breeding enterprise in Bavaria. The tests were carried out on several days with manure from different fattened pigs and dairy cattle from six farms. Separation efficiency for dry substance was over 80%, for nitrogen it was more than 40% (manure from fattened pigs) and more than 60% for manure from dairy cattle. For phosphor, separation efficiency was especially high at more than 90%. The table below gives an overview of the results.

| Test result/separation efficiency | Manure from fattening pigs | | Manure from | Manure from dairy cattle | |
|---|----------------------------|-------------|--------------------|---|--|
| | Test result | Evaluation* | Test result | Evaluation* | |
| Fresh weight | 13% | n. e. | 29% | n. e. | |
| Dry substance | 83% | ++ | 89% | ++ | |
| Total amount of nitrogen | 41% | ++ | 67% | ++ | |
| Phosphor | 96% | ++ | 92% | ++ | |
| Potassium | 23% | 0 | 43% | ++ | |
| ••••••••••••••••••••••••••••••••••••••• | | | •••••••••••••••••• | ••••••••••••••••••••••••••••••••••••••• | |

* Valuation area: ++ / + / | / o / -- (o = standard, n. e. = no evaluation)

The complete DLG test report can be downloaded free of charge at: www.DLG-Test.de

Technical Test Data:

- The separation equipment is available as a closed system in a mobile 20 ft container, placed on a truck chassis.
- There is a mixing section from the entry of the container to the decanter for conditioning; stainless steel pumps, including taps for sample taking of the discharge substrate and the flocculated substrate.
- 2 stainless steel vessels, each with a capacity of 1 m³ for the additives, including dosing pumps for introducing the additives into the tube
- Flowmeter (MID) for the original substrate (manure, fermentation residues or sewage sludge) as well as for the additives 1 and 2
- NIR sensor for determining online the dry matter content of the introduced substrate
- Flottweg Decanter centrifuge Z3E, with a maximum capacity of 5 m³/h and an actual capacity of up to 300 kg of solids per hour
- · SPS control system, including a logbook and a remote control module
- Required electrical capacity: 63 A, 400 V

13

SUCCESS IS...

ALWAYS BEING IN GOOD HANDS

The DLG test has confirmed that the mobile processing system for manure MoROPlant20 works excellently. It is, however, decisive what your precise requirements are. Where is manure separation intended to take place? Do you wish to use the system at several sites? What kind of manure do you wish to process, and in which quantity? What is to be done with the dry substance and the process water afterwards? Let us find out in an advisory interview which solution is going to be the best one for you.

Testing, Renting or Buying a Machine?

If you are not sure whether the mobile processing plant is appropriate for your farm, or if you want to determine your specific separation efficiency in advance, we can offer you a test system. Contact us! Considering some operational factors, we will find out which is the most economical solution for you in the long term: renting or buying a system.

Customer Service Everywhere and at Any Time

Even the best machinery needs to be maintained and serviced. Flottweg has established a worldwide service network consisting of its own subsidiaries, branch offices and representatives to provide our customers with localized service and spare parts. Our service engineers and technicians are qualified for any kind of installation, commissioning, repair, and maintenance. The Flottweg service group is also available to perform preventive maintenance in order to avoid undesired downtimes of your system.

We look forward to your inquiry:

Phone: + 49 8741 301-0 E-mail: mail@flottweg.com



| Туре | MoRoPlant20 | MoRoPlant20+ | MoRoPlant40 | Individual | | | |
|--------------------------|---|----------------------------|------------------------|----------------|--|--|--|
| Materials | All product-wetted parts are made of corrosion-resistant stainless steel. | | | | | | |
| Dimensions (I x w x h) | 6058 x 2438 x 2591 mm | 7820 x 2438 x 2591 mm | 12192 x 2438 x 2591 mm | individual | | | |
| Gross weight | approx. 9000 kg | approx. 13000 kg | approx. 20000 kg | individual | | | |
| Required power | 63 A | 125 A | 250 A | individual | | | |
| Mobile | yes | yes | yes | no | | | |
| | | Capacities | | | | | |
| Pig slurry | up to 5 m³/h | up to 10 m ³ /h | up to 20 m³/h | up to 200 m³/h | | | |
| Cattle slurry | up to 2 m³/h | up to 5 m³/h | up to 10 m³/h | up to 100 m³/h | | | |
| rmentation residues/slop | Due to different raw materials, the capacity for biogas may vary considerably. Please contact us for individual information. | | | | | | |
| Possible operating hours | 24/7 | | | | | | |

Technical data of the Flottweg MoRoPlant*

* The listed figures are merely guidelines. Actual capacity depends on the individual characteristics of the product. Subject to technical changes.



REERENCES















Flottweg SE

Industriestraße 6-8 84137 Vilsbiburg Germany Tel.: + 49 8741 301-0 Fax: + 49 8741 301-300 mail@flottweg.com www.flottweg.com

E-V00/10/2019