

# Handling and unloading non-free flowing materials

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## ABSTRACT

The handling of non free flowing materials, such as soybean meal (SBM), is a difficult task compared to that of the free flowing materials like wheat, as the tendency to compact SBM makes the unloading from ships a difficult and risky operation.

In order to simplify the process, SBM can be cooled down before loading or have a reduced oil content. However, the problem is not just evident in the unloading process but also in the storage of the material, mainly at flat storages.

Various equipment can also be used to facilitate and ensure this process is completed in a safe and relatively risk free manner. These machines include discontinuous or batch unloaders like grabs, Mechanical Continuous Ship Unloaders (MSU) and Pneumatic Ship Unloaders (PSU), all of which have advantages and disadvantages to be discussed.

Most operations require the constant use of bulldozers to feed the unloader. This makes the operation dangerous as negative walls can easily be created and the operator inside the bulldozer can be over flooded. The dust makes it also difficult to work on the engines and precaution should be taken to avoid dust explosion.

The main problem is that there is not a 100% solution that removes the need for a person to enter the ship's hatch.

In order to understand the unloading operation in a better way, the advantages of different systems when unloading SBM are discussed.

## Grab Crane

The grab unloader is the machine that is most widely used, in conjunction with the correct grab and environmental hoppers. By using different grabs for each product helps avoid contamination and ensures safety. It also helps the user to be quicker and increase efficiency.

The main problem with using grabs to fill SBM is that the filling of the grab is difficult and time wasting. Also the discontinuous operation is more difficult to patrol and requires constant attention from the operator. The weight of the equipment is high because a hopper should be available to serve as buffer for the batch handling.

## Chain unloaders

The chain unloader is a mechanical continuous system that is used for free flowing materials. The advantage of this system is the relatively low power consumption, especially when large capacities are needed.



Figure 1. Chain unloader at clean up.

For unloading SBM, the problem can come in the feeding of the material into the conveyor and therefore there is the tendency to make a hole. Additionally, the machine cannot lift all of the material as it must be immersed in some depth in order to fill. This means there is often a substantial amount left in the ship after unloading, which must be cleaned out by other means. The use of bulldozers is also required for the feeding process.

The use of feeders such as attached scrapers, are possible but unfortunately makes the equipment heavy and consequently expensive. Additionally the movement of the cargo with a scraper and chain conveyor generates dust and hinders the vision of the operator.

## Screw conveyor and feeder

The screw unloader uses a feeder to transfer the material into the screw conveyor, which rotates in the opposite direction than the feeder. This machine is suitable for SBM without the intensive use of bulldozer to feed the unloader. The main disadvantages of this system are the price, weight, wear and the possibility of jamming if foreign material enters the screw-system.

## Pneumatic

The pneumatic unloader has the same disadvantages of the chain unloader but has the ability to take all of the material out of the ship. The pipe system makes a hole in the material, while a bulldozer then pushes the material feeding the nozzle. Simple systems, such as cutting devices, make the hole bigger but also need to use bulldozers to get a reasonable unloading rate.



Figure 2. Pneumatic unloader with feeder.

## Pneumatic and feeder

This system is a combination of the feeder of the screw unloader and the pneumatic conveying. The advantage of this system is a feeder, such as the screw, transfers the material into the suction nozzle, reducing the problem of jamming from foreign materials. It can also be equipped with an additional kick-in and -out and a slewing system so as to reach the areas under the ships hatch. The system is also said to be environment friendly, emits little noise and reduces dust by sucking it back into the system. In order to avoid the jamming effect at the airlock, a special belt airlock can be used. In this case the SBM can also contain foreign materials without having any operation time loss caused by airlock jamming.

## Case study: Biomass

Beside feedstuffs, another area has been developed to use this type of continuous ship unloader for non free flowing materials. Recently a coal power plant bought a pneumatic and feeder unloader for a biomass project. This use of renewable energy is being supported by the government, in order to reduce the consumption of fossil energy and the subsequent production of carbon-dioxide.

### ABOUT THE AUTHOR

Tomas Kisslinger has twenty years experience in bulk handling, specially in grain related areas. Since 1992 he has been Managing Director of NEUERO Industrietechnik.



Figure 3. Caption needed

However, the main problem is that power plants have high safety and environmental standards and require a high availability of equipment. Additionally, the products to be handled vary in size and specific weight – light materials are very difficult to be handled with grabs, particularly when low dust contamination is required.

Because of its characteristics, a pneumatic and feeder system was chosen to handle these materials. This will be the first pneumatic unloader Biomass to be installed at a power plant.

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