TECHNICAL INFORMATON
DECEMBER 2020

Multi-Ingredient-Handling

Automation of dosing and mixing systems

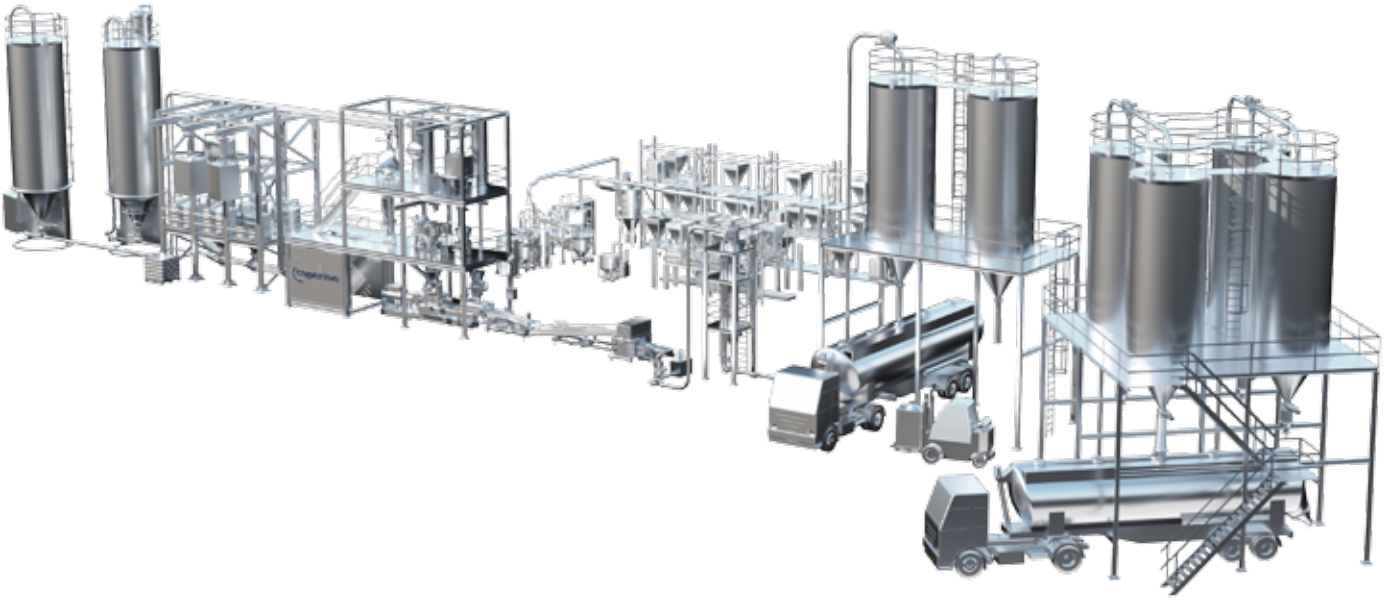
coperion
confidence through partnership

BASICS OF MULTI-INGREDIENT-HANDLING

Increasing demands in plastics processing require an increasingly demanding adaptation of plastics properties to their later application. As a consequence, plastics are more and more often optimized by application-specific supplementation with fillers and additives. This growing variability increases the need for flexible automation in the production of premixes, which are made up of different ingredients in various quantities and shapes.

What is a MIH system?

Multi Ingredient Handling Systems (MIH systems) cover all steps from the arrival of the ingredients at the processor, through dosing, to the mixing of premixes. Depending on the quantity and the required accuracy, gravimetric dosing is carried out manually or automatically. In order to ensure a smooth dosing process, MIH systems also include intralogistic applications related to premix production.



Main areas of a MIH system

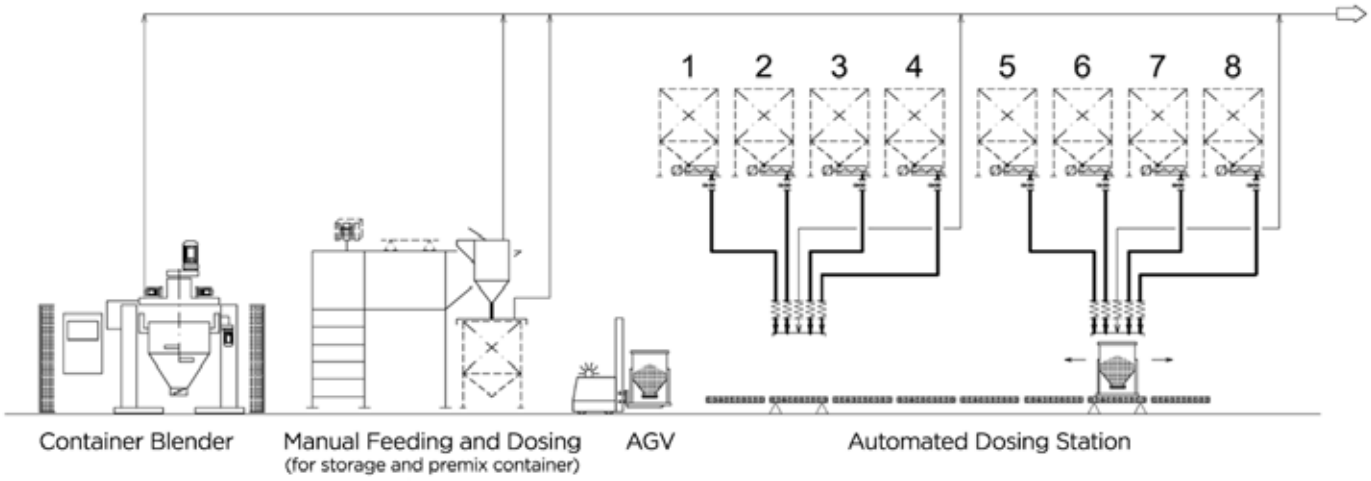
MIH systems can be divided into four main areas:

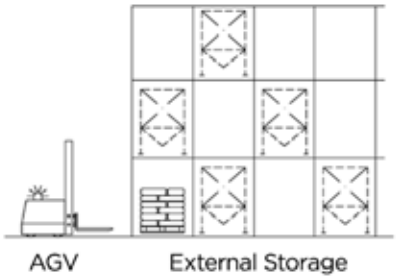
- Storage
- Dosing
- Blending
- Transportation

Field of application

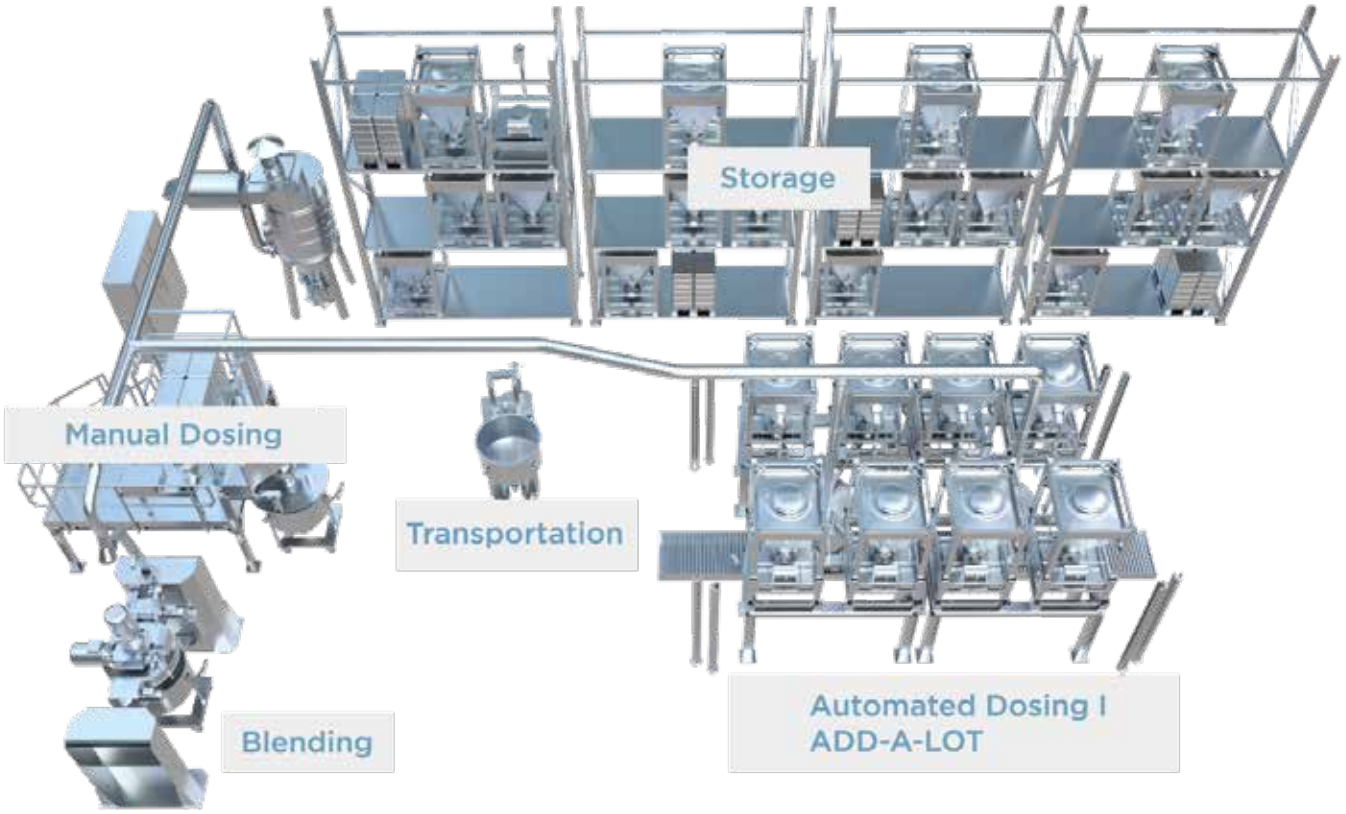
MIH systems can be used wherever premixes are produced from different individual ingredients. Due to the modular design, each system can be individually adapted to the requirements.

The origin of MIH systems lies in the processing of plastics. In the so-called compounding process, a premix of various additives is added to a base polymer to influence the properties of the subsequent plastic.





The illustrated flow sheet covers the four main groups of a MIH system. The structure is additionally shown in a 3D model for better understanding.



STORAGE

Multi-ingredient-handling, as the name implies, is based on the processing of a large number of ingredients. As the number and variability of the products used increases, the size of the dosing station in conventional dosing systems rises significantly, both in terms of space and cost, as each product requires its own dosing hardware.

To counteract this, the MIH concept is based on exchangeable storage receptacles, which are only used if the respectively contained product occurs in the recipe. Containers which are not required can be stored outside the dosing area to save space. On the one hand, this reduces the space required in the active dosing area while on the other hand the number of dosing hardware required is reduced to the active ingredients in the dosing.

Some of the transport receptacles commonly used for bulk materials can be used directly at the respective dosing points (IBC, bigbag) or are transferred into standardized receptacles (bag, octabin) using equipment designed for this purpose. Furthermore, pneumatic feeding from silos is possible too.

The most common storage receptacles are:

- IBC (Intermediate Bulk Container)
- FIBC (Flexible IBC)
- Bigbag
- Octabin
- IBC with backfill chute
- Silo

DOSING

Dosing is the core of a MIH system and can be carried out automatically or manually. However, it can generally be assumed that the less frequently a component is used and the higher the requirements for dosing accuracy are, the more likely manual dosing will be applied. For both manual and automated dosing of bulk material, aspiration must be provided due to the expected dust formation. In addition, both types of dosing have a control system, which in the case of manual dosing is implemented in form of a operator guidance system.
Coperion K-Tron offers a wide range of dosing solutions that have been particularly developed to fulfill the needs of the plastics processing industry and which are used when high requirements are placed.

Automated Dosing | The ADD-A-LOT

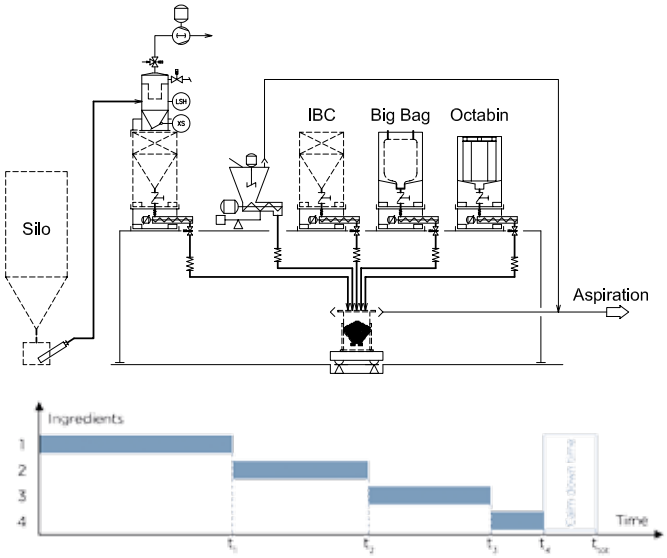
The ADD-A-LOT is typically used as a component of a MIH system, whereby the number of ADD-A-LOTs is adjustable. The discharge station of the ADD-A-LOT is used to connect the storage and receiving container and is applied for the discharge and dosing of bulk material. Depending on the design, up to eight storage receptacles can be arranged above one receiving container. The dosing is realized by a weighing control system and the screw geometry is selected according to the bulk material. A pneumatic butterfly valve or a slide valve is provided on the outlet side to prevent inflighting material. Additionally, supporting mechanical and pneumatic discharge aids can be installed.

WEIGHING PRINCIPLES

During weighing, a differentiation is made between additive *(weighing the premix container)* and subtractive *(weighing the storage container)* weight recording.

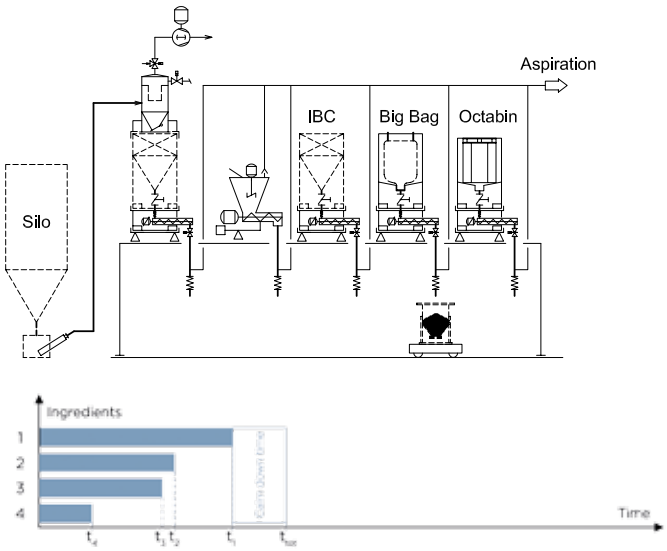
Additive weight recording

With additive weight recording, the container that receives the ingredients is weighed. In order not to influence the measurement, it is ensured that all dosing hardware is not in contact with the weighed premix container. Instead, the connection between the discharge station and the premix container is achieved by a smart combination of aspiration and a stationary container lid. The use of additive weight recording offer the advantage that less weighing equipment is required for the same number of dosed components.



Substractive weight recording

For subtractive weight recording the weight change of the storage containers is considered. Therefore, load cells are installed in the framework of the discharge station. This approach enables the simultaneous dosing of several components into the same container and also allows a physical connection between discharge station and premix container. Each premix container is equipped with an individual lid and the connection is made mechanically by a bellows located at the outlet of the dosing equipment.



DESCRIPTION OF THE ADD-A-LOT

The storage container can be positioned on the discharge station using a crane or a forklift truck. Then the two parts can be connected by moving the sealing flange vertically before the storage tank butterfly valve is automatically opened.

Dosing is usually carried out by dosing screws, which end in the connection of the discharge station to the premix container.

Discharge aids

Depending on the contained product, the ADD-A-LOT is equipped as standard with discharge aids that prevent bridging and enable a complete emptying of the container. The most frequently used discharge aid is the pneumatic hammer, but the use of vibrators is also possible.

MANUAL DOSING

Static storag

Static storage is also known as KCV (small chemicals weighing system). The various products are filled into stationary compartments and are removed from them manually. The use of operator guidance systems enables reliable traceability of the recipes and a simultaneous reduction of error batches.

Dynamic storage

In dynamic storage, the various products are filled into standardized boxes, which are stored in a chaotic way in the rack storage area with stacker crane or in a circulating shuttle. The loading and unloading of the storage boxes takes place at one dedicated spot.

The advantages of dynamic storage are a very good use of space and minimal effort for the worker, as he can withdraw any component at the same spot. In addition, chaotic storage allows different quantities of the individual products to be stored. On the other hand, the lower investment costs and the safe handling of hazardous products are arguments for static storage solutions.

BLENDING

Mixing is a small but not negligible part of a MIH system, which turns the dosed ingredients into a premix that is as homogeneous as possible. Coperion has a large number of experienced partners in the field of mixing technology and the necessary container mixers.
For the special case that the premix consists exclusively of granular bulk materials, the Mix-A-Lot from Coperion is used.

TRANSPORTATION

Both the exchange of storage containers and the transport of the premix IBCs are fundamental to the operations of a MIH system. In addition, intralogistics is an important control lever for the degree of automation of the system.

Manual transportation

The manual transport performed by the worker is the most flexible solution in the MIH system. In addition to moving the containers by hand, this also includes any activity that is carried out with man-controlled transport aids, such as pallet trucks.

Conventional conveyor technology

Classical conveyor technology in the narrower sense includes floor-bound conveyors such as roller conveyors or chain conveyors. These extremely reliable transport systems are particularly suitable for high transport throughput. For this reason, classic conveyor technology is mainly used for transporting the premix IBC and not for handling the storage containers.

Automated guided vehicle

Automated guided vehicle systems (AGV systems) rely on a varying number of transport vehicles depending on the scenario and task. The focus is primarily on freely orientated systems, which can simulate the functions of manual transport due to their flexibility and scalability. While flat AGVs are used for transporting premix IBCs that underpass the load, lifting AGVs are also used for the more demanding handling of storage containers.

T-900402-en 2020-12 | Subject to changes

Coperion GmbH
Niederbieger Strasse 9
88250 Weingarten, Germany
Tel.: +49 751 408-0
Fax: +49 751 408-200

info@coperion.com
www.coperion.com

coperion
confidence through partnership