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Safety and Sustainability Spotlight : Choosing Eco-friendly Sifting Machines for a Greener Future

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ABSTRACT

In the nuanced domain of sugar production, the integration of a sifter transcends mere equipment acquisition, embodying a critical juncture in operational efficiency and product quality. Precision in particle separation and the mitigation of agglomeration and screen clogging are paramount, necessitating advanced technological solutions. The dynamic interplay of cutting-edge technologies, rigorous research, and unwavering quality control forms the cornerstone of contemporary sugar processing. Addressing the looming threat of dust explosions, a paramount concern in sugar mills, necessitates a meticulous approach to particle size management and sifter system integrity. The deployment of sifters with static housing emerges as a pivotal strategy, curtailing dust contamination risks and aligning with stringent safety standards like NEC 500 and ATEX. This proactive stance on safety dovetails with a broader commitment to sustainability and energy efficiency, where the nuanced choice of sifter technology can significantly influence lifecycle costs and environmental impact. As the industry navigates the challenges of energy consumption and environmental stewardship, the selection of energy-efficient sifting solutions stands as a testament to a forward-looking ethos. This holistic perspective not only addresses immediate operational needs but also champion's long-term sustainability and economic viability, urging decision-makers to contemplate the broader implications of their choices. What may appear as a modest investment initially can, in reality, define the true cost-effectiveness and environmental impact over the entire lifespan of the machine.

Keywords : Sifting machines, cost-effectiveness, environment impact, sugar industry.

INTRODUCTION

The production of sugar is a fascinating process that spans centuries of human history and involves a blend of agricultural, chemical, and industrial techniques. Throughout the production process, stringent quality control measures are implemented to ensure the purity, safety, and consistency of the sugar. Environmental sustainability and resource efficiency also play significant roles, with modern sugar refineries employing advanced technologies to minimize waste and reduce environmental impact.

Therefore, the acquisition of a sifter in the production may seem trivial at first glance and a variety of factors need to be considered. In the challenging world of sugar processing, precise separations into multiple fractions on a sifter are crucial. Additionally, the shape of sugar particles poses a potential risk of agglomeration, which leads to another task as well as a clogged screen mesh can a negative effect on the screening result.

These listed challenges require, among other things, innovative solutions to ensure an efficient and smooth operation. When it comes to safety in sugar processing, strict procedures are required, including training and modern safety technologies, as manufacturers want to make sure that all employees return healthy to their

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families afterwards. For instance, it was only at the end of January that employees at a German sugar plant were seriously injured in an industrial accident caused by the leak of caustic soda. According to initial findings by the authorities, the corrosive liquid leaked from an outdoor container, causing the accident.

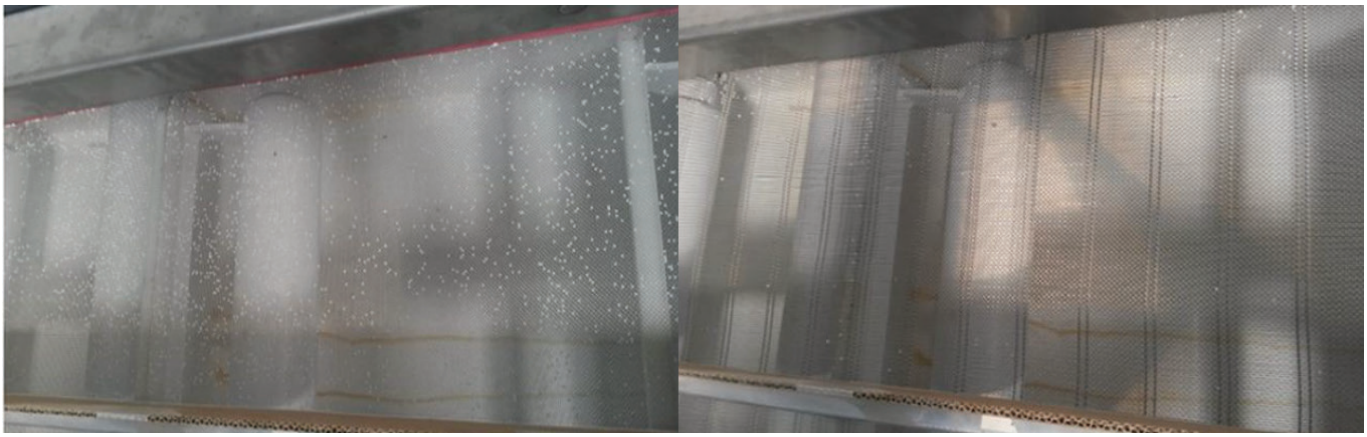

Figure 1 : Illustrates a clogged screen mesh with as quare opening in the fertiliser industry (on the left), which has been improved by the use of rectangular screen mesh openings (on the right) (source: RHEWUM)

Maintaining high quality standards is decisive for the colour, crystal size and taste of the end product. In order to ensure the consumer's safety, hygiene requirements in the food sector must be strictly adhered to. Therefore, clean production environments and the use of advanced technologies are needed to maintain the highest hygienic standards.To fulfill these complex requirements, a combination of enhanced technologies, continuous research and development along with strict quality controls are mandatory.

However, in addition to technical compatibility, economic efficiency, sustainability and safety must of course also be ensured these days.

Quality implications of dust in sugar

Ensuring safety in sugar factories globally is paramount, with dust explosions posing a significant threat.

Typical places in the manufacturing process where sugar dust occurs are filters, silos or conveyor systems such as bucket elevators. Preventive measures, i.e. the avoidance of explosive atmospheres, can hardly be realised economically at such locations. In silos, the dust is repeatedly stirred up during storage and transfer; in bucket elevators, the excess sugar trickles off and accumulates in the air. Due to the air movement, the dust particles can also remain in the air for longer than usual. Customised protective equipment is thus required to ensure effective and economical protection against the consequences of a possible dust explosion. Particularly in screening technology where minor errors can escalate into hazardous process conditions, and often leading to catastrophic consequences such as costly damages, injuries, or even fatalities in the unfortunate event of an accident.

Sixteen years ago, there was a tragic sugar dust explosion in Georgia in which more than 10 employees died (Figure 2). In case anyone didn't notice the accident, because you can hardly find any detailed literature about it on German-language websites and news, the original explosion took place in the centre of the sugar silo. However, the sugar whirled up in other areas of the refinery, causing subsequent explosions. The force of the explosions and the subsequent fires destroyed the buildings for sugar packaging, the palletising room and the sugar silos and damaged the train loading stations and large parts of the sugar production facility significantly. The incident was investigated by several US authorities.The U.S. Chemical Safety and Hazard Investigation Board (CSB) published a report about the incident in September 2009 and declared that the explosion could have been avoided

Figure 2 : Georgia imperial sugar refinery explosion (source: USCSB)

After this serious safety incident, the US Chemical Safety Board asked the Occupational Safety and Health Agency join forces with the National Fire Protection Association (NFPA) to develop a set of standards for flammable substances. By adhering to these standards, companies must ensure the prevention and containment of explosions in the process industry.

To avoid possible grain dust explosions, particle size of the product is crucial. Meaning the explosion risk for the producers increases with decreasing the size. A study by the NFPA found that a dust accumulation the thickness of an average paper clip can be enough to trigger explosions. Crushing creates large surfaces, causing dust particles to rapidly oxidize and easily ignite, posing a significant hazard. To avoid such devastating dust explosions, it is important to keep the sifting system dust-free. Dust accumulates on equipment surfaces, stairs, railings and light fittings. Although visible surfaces are cleaned regularly, they are explosive. Considerable dust can build up on overlooked, hidden surfaces. Consequently, routine cleaning of both exposed and hidden areas within the facility is essential to minimise hazards.

Figure 3 : RHEWUM sifter in the sugar industry (source: RHEWUM)

In the interior of the system, the build-up of excessive heat and sparks should be prevented. For instance, when designing the installation, care must be taken to ensure that ignition sources cannot enter the production process. For example, an upstream screening machine (Fig. 3) can prevent foreign objects or excessively large product particles from entering a process. In order to prevent parts of the sifter itself from entering the process in the event of a fault, components such as sifting aggregates must be made of magnetizsable material. In this way, a magnetic separator can intercept any fragments.

Furthermore, when several companies are involved in the construction of a system, a good interplay is essential. For example, the supplier of a downstream process step must know which potential ignition sources can enter their part of the system. Therefore, sifters with a static housing are well-suited for the sugar industry, since the housing eliminates prone-to-failure hose connections. This is a common cause of dust contamination in the system.

Moreover, the machines should be designed and manufactured in strict compliance with NEC 500 or as a Europe more common ATEX guidelines to be even safer. In many people's minds, ATEX is still synonymous with expensive systems. It is associated with customized products, complicated individual approvals and a huge amount of paperwork. However, the cost of explosion protection has fallen significantly since it was introduced across the industry. This is mainly due to the fact that frequently manufactured system components are now usually type-tested, thereby eliminating the need for expensive individual approvals. In the bulk solids processing industry, many machines are now manufactured in accordance with ATEX guidelines as standard for a small additional charge.

After all constructive explosion protection combines a high level of safety with long-term cost-effectiveness and thus creates the conditions for the necessary level of protection for people and systems. This gives plant operators the certainty that they are acting in accordance with the relevant regulations on operational safety.

Shaping a greener future

Besides, these essential safety benefits of a directly driven sifter, they also offer additional aspects, such as the already mentioned static housing. The fixed flange connections and minimal vibration transmission to the screening machine environment offer another important benefit for the producers. In a long-term perspective, these contribute to a commercial advantage.

Despite the fact of investment costs, the amount of lifecycle costs should not be underestimated and taken into account. It is well known that the sugar industry is energy-intensive, but the good news is that a lot of energy can be saved in production. To keep unavoidable maintenance cost into consideration by searching for the correct sifter is well-known,known; there is a somewhat inconspicuous yet significant cost driver—the specific energy consumption of the sifter type used. Manufacturers the world over are actively searching for reliable supplies of affordable energy since the global economy has changed drastically in recent years. Accordingly, plant operators should generally account for future increases in electricity prices.

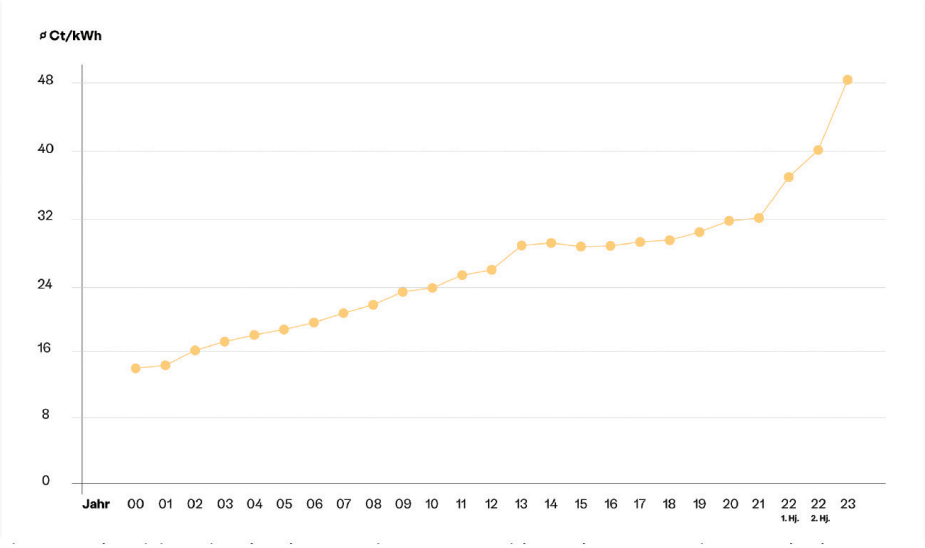

Figure 4 : Electricity price development in germany with yearly consumption 3.500kWh (source: Bundesverband der energie - und Wasserwirtschaft)

Electricity prices fluctuate in most countries around the world. As a result, an international comparison can produce different results depending on the time of data collection and volatile prices can also be found within Europe. Thus, in 2023, on average, German producers paid nearly three times more than customers in the USA or Canada (Fig. 4).

Capital goods like screening machines are typically operated continuously for decades with a long service lifetime, for an investment decision made today, a corresponding price scenario is not improbable.Thus, when making investments or replacing existing facilities and components, it is essential to take all relevant costs into consideration. Because the return on investment (ROI) of an investment should cover both direct costs such as purchase price and maintenance costs as well as indirect costs (e.g. training, overheads).

In a case study in the sugar industry for classifying 30 tonnes of white sugar per hour in 4 separations, a sifter with a total of 32 drives is used. This means that there are 8 drives per deck with an output of 0.16 kWh with RHEWUM drives. In April 2024, the average electricity price in the USA was 15.45 cents per kilowatt-hour, which means the following:

0,16 kWh x 8 drives x 4 screening surfaces = 6,4 kWh in total

6,4 kWh x 15.45 cents per kWh = 98,88 cents → 1 Dollar per hour

Accordingly, a directly driven screening machine, which is running on the basis of 8,700 operating hours per year would require yearly electricity costs of USD 8,600. Simplified, it can be assumed that a directly activated screening machine generates only 30% of the energy costs compared to an indirectly (conventionally) driven screening machine. Even though sifters often play a subordinate role in the energy consumption of entire production processes, a consideration of energy efficiency will become increasingly important in the future, especially given their long lifecycle as capital goods.

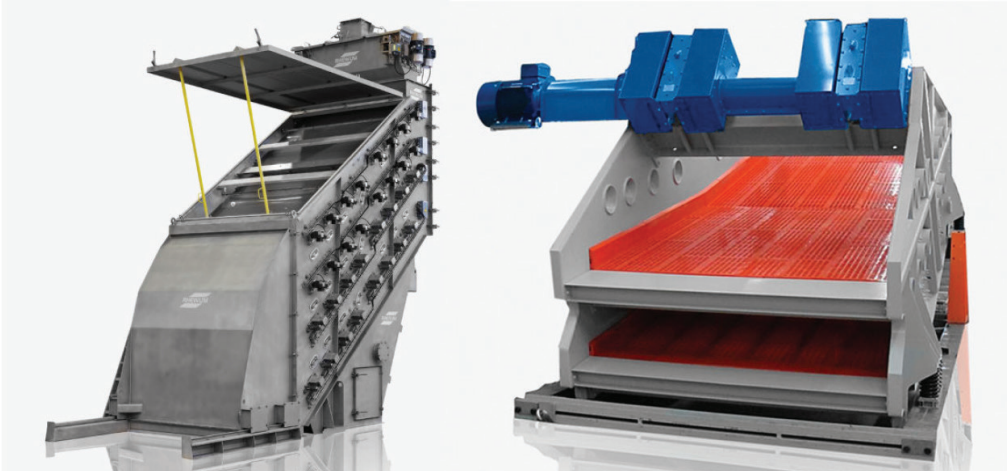

Figure 5 : Directly driven sifter, type RHEfino and indirectly vibrating screen, type RHEox (source: RHEWUM)

Producer with a passionate commitment

The use of screening machines with a static housing in combination with directly excited screen cloths is proving to be a key strategy. In addition to the reduced risk of dust contamination and improved energy efficiency, an additional topic is the commitment to sustainability.Accordingly, the US government has programs to promote sustainability in the sugar industry Fuels Standard (RFS), and the Energy Independence and Security Act of 2007 (EISA).

The RFS requires that a certain percentage of transportation fuel sold in the United States each year come from renewable sources, such as ethanol. Ethanol can be produced from sugarcane, and the RFS has helped to increase the demand for sugarcane and ethanol in the United States.

On the other hand, EISA also includes provisions that support the sugar industry. EISA provides funding for research and development of new technologies for the sugar industry, and it also requires that the Environmental Protection Agency (EPA) consider the environmental impacts of biofuels when setting fuel standards. Through the RFS program, demand for sugarcane and ethanol has increased over the past few years, while EISA has provided funding for research and development. As a result, the sugar industry in the US is a greener industry with less pollution and less water consumption than in the past.

In addition to the government programs mentioned above, the sugar industry also has voluntary sustainability initiatives in place. These initiatives are designed to improve the environmental and social performance of the industry. Some of the most important voluntary sustainability initiatives in the sugar industry include:

- The Bonsucro Standard: The Bonsucro Standard is an international standard for sustainable sugarcane production. It is designed to promote the use of sustainable practices that reduce the environmental impact of sugarcane production, such as using less water and pesticides.
- The Sugarcane Sustainability Initiative (SSI): The SSI is a partnership between the National Sustainable Agriculture Coalition (NSAC) and the American Sugar Alliance (ASA). The SSI is designed to promote the adoption of sustainable practices among sugarcane farmers in the United States.
- The Sugarcane Environmental Leadership Program (SELP): The SELP is a program that provides financial and technical assistance to sugarcane farmers in the United States who are working to improve the environmental performance of their farms.

RESULTS AND CONCLUSION

These voluntary sustainability initiatives are helping to make the U.S. sugar industry even more sustainable. By adopting sustainable practices, the sugar industry can reduce its environmental impact and improve its social performance.

In embracing energy-efficient solutions for the future, the global shift towards sustainable and safe practices underscores the importance of a forward-thinking approach. What may appear as a modest investment initially can, in reality, define the true cost-effectiveness and environmental impact over the entire lifespan of the machine as well as your plant. So, choose wisely, not just for today, but for a greener and economically responsible future.