Perkolatwasseraufbereitung als Verfahrensschritt zwischen dem Perkolator und dem Fermenter am Beispiel des ISKA® - Verfahrens

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Percolation water treatment as a process step between percolator and digester

Abstract

Within the scope of mechanical-biological treatment for municipal waste the company Hans Huber AG supplies in a first step mechanical solutions for separation of heavy materials and grit. By using special screening equipment fibrous material is separated in a second step. The entire process step is managed without addition of fresh water. All upflow and cleaning water required for cleaning the filter surfaces is won from the percolation water. The particle separation size for grit and other heavy materials is 1 mm; also all fibrous materials are separated from the suspension at 1 mm. All separated material flows are dewatered in integrated screw press zones.

Abstract deutsch

Im Rahmen der mechanisch-biologischen Abfallhandlung für Restmüll liefert die Fa. Hans Huber AG in einem ersten Schritt Maschinentechnik zur Abtrennung von Schwerstoffen und Sand. In einem zweiten Schritt werden über spezielle Siebanlagen Faserstoffe abgetrennt. Der gesamte Verfahrenschritt wird ohne Zugabe von Frischwasser aufrecht erhalten. Sämtliches Aufstrom- und Reinigungswasser für die Abreinigung der Siebflächen wird aus der Perkolatsuspension gewonnen. Die Abscheidegrenze liegt für Sand bei 1 mm. Faserstoffe werden ebenfalls mit 1 mm aus der Suspension abgeschieden. Alle abgeschiedenen Stoffströme werden mittels integrierten Schneckenpresszonen entwässert.

Keywords

Percolation, fibre separation, grit separation, fermentation, waste treatment

1 Brief description of the complete process

The presented percolation system is a patented process technology for mechanical-biological waste treatment (MBA).

a) Process principle:

Residual waste consists mainly of organic material, metals, inert mineral substances and water. In the ISKA® process, all these different substances are separated so that they are available for individual disposal. The separation of the water contained within the waste and of mineral material as well as the decomposition of organics lead to mass reduction, normally to half the initial weight. Specific customer requirements can easily be met by offering three versions of the ISKA® concept: material recycling as fuel, thermal waste treatment, disposal to landfill. Plant features:

· High technical standard

· Maximum level of automation

· Minimum odour emission (30 BImSchV)

· Very maintenance-friendly technical components

b) Technical description:

The waste is pre-treated prior to percolation. After delivery the waste is separated by screening into relatively dry highly caloric oversized particles that are low in biogenics and the organic laden wetter undersized particles. Only the undersized particles are passed on to percolation after magnetic scrap removal. The oversized particles with a high calorific value are energetically utilised after removal of iron particles.

The main part of every ISKA® version is the percolation process. This new patented process for treatment of organics laden waste combines the process steps of aerobic decomposition and anaerobic fermentation.

In the first treatment step, the forced ventilated percolator, the soluble organics contained within the waste are separated along with the released water. In the second treatment step the organics laden percolation water is under exclusion of air fermented to biogas. In addition, a high rate of minerals is separated. In a block heat and power unit the biogas is transformed into electric energy and reusable exhaust heat.

The percolator is a horizontal cylindrical tank with a horizontal stirrer installed to mix and break up the waste and thus support the disintegration of organic particles. Feeding of the waste with the circulated percolation water is discontinuous through nozzles in the tank ceiling. The percolate water completely penetrates the waste. On its way back into the water cycle the percolate water carries with it the soluble organics and fine grained minerals, which are then discharged through the perforated tank bottom. Variable pressure air surges ensure sufficient aeration of the waste in the percolator. Favourable is aerobic decomposition, which attacks the organic cell substance at an ambient temperature of approx. 45 °C and a slightly acid pH and achieves an additional solubility of organics through acid hydrolysis.

In the water cycle, a grit washer and fibre separator remove the solids from the percolation water under exclusion of air at reducing conditions. The solids are then fermented in proven and tested digesters. Whilst the grit is discharged, the fibres are returned into the percolator. The biogas produced in the digester (with a methane content > 65 %) is fed into the block heat and power unit for energy recovery with gas motors.

The following stage provides for circulation water treatment and discharge of the supernatant released from the waste. The supernatant is treated so that it can be discharged into the public sewer system.

Pre-treatment and percolation already achieve a mass reduction to approx. 50 % of the input, subject to 40-50 % water content in the residual waste. The drier and poorer in biogenic substances the waste to be treated, the smaller is the mass reduction. If the DS content in the waste is > 75 %, the efficiency of the entire process must be examined on a case-to-case basis. Depending on the biogenic load within the waste, the biogas yield lies between 40 and 110 standard cubic metres per ton of waste and leads at least to a complete energy autarky of the process. Normally, excess energy can be delivered to a third party.

The three ISKA® systems differ primarily in the selected disposal routes and thus the applied secondary treatment.

ISKA® type 1 is the TASI conform material recycling of pre-treated waste as fuel. In the secondary treatment stage the percolated waste and screening residues are comminuted prior to drying with the use of exhaust air of the gas motors and removal of dense material and metals by means of sifters. The dried waste with > 85 % DS content is finally compressed to highly caloric high-density pellets or briquettes. The energy required for this way of secondary treatment can be covered by biogas utilisation, provided the water content of the waste is 40-50 %.

ISKA® type 2 is selected as a TASI conform pre-treatment prior to an existing or new thermal treatment according to 17. BImSchV. No further treatment is required if the material is incinerated directly. Other incineration methods may under certain circumstances require prior comminution. The advantages of this system variant are low pre-treatment costs, weight reduction and thus reduced costs for disposal of the waste to be incinerated and reduced costs for transport prior to thermal treatment.

With ISKA® type 3 existing TASI conform landfill capacities can further be used even after 2005 through corresponding waste pre-treatment. For further minimisation of its biological activity the percolated waste is after-treated by rotting for several weeks in a closed hall that is deodorised by biofilters. The highly caloric screening residues are passed on to thermal utilisation or gasification.

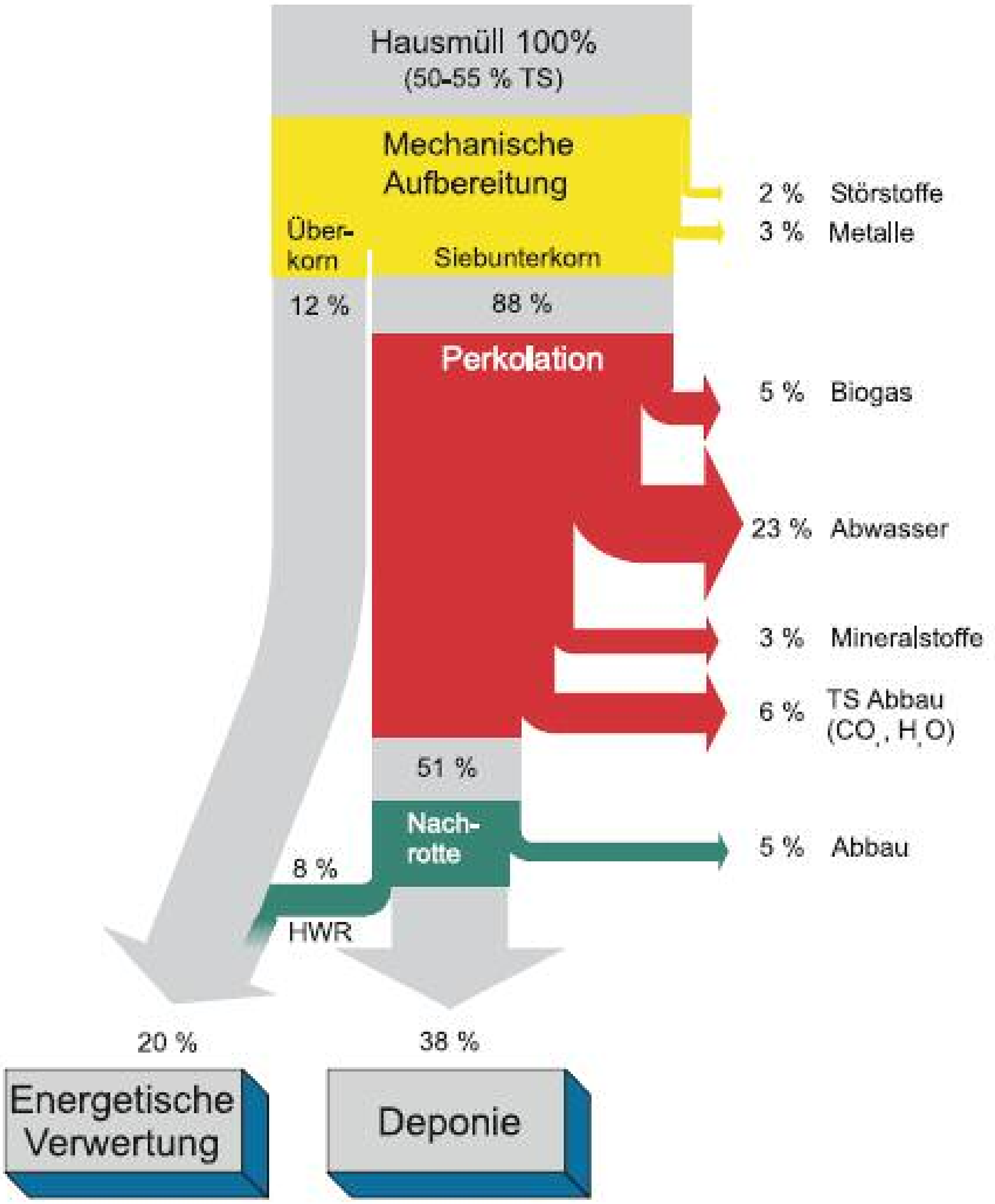

Figure 1 Material flows in the ISKA® process

2 Dense material, grit and fibre separation

The liquid phase exiting from the percolator contains besides the high organic load other diverse disturbing substances, mainly grit, glass, stones and fibres. These materials are separated in a two-stage process to ensure that the suspension is virtually free of disturbing material when fed into the fermenter. Figure 2 shows the individual material flows graphically.

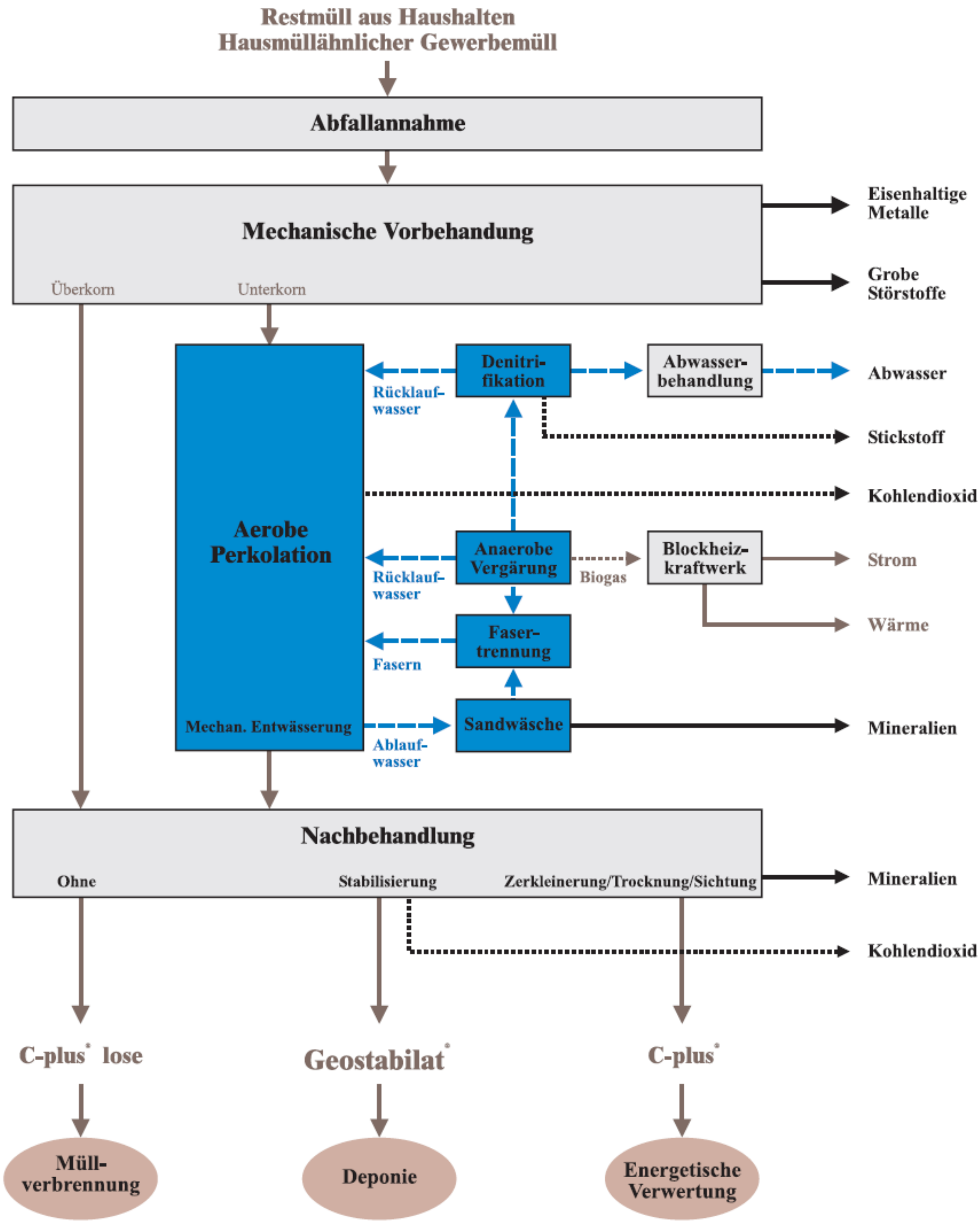

Figure 2 Flow diagram of dense material and fibre separation

2.1 Dense material and grit separation

For the first treatment stage, which separates dense material and grit, machines are applied that have been developed especially for the ISKA® process. The percolator substrate is fed into the HUBER ROTAMAT RoSF4 via a horizontal feed channel. The concical trough separates the grit and other dense material from the actual suspension by means of sedimentation. The sedimentation process is supported by pumping in upflow water and air. A separation efficiency of below 1 mm grain size can in this way be achieved. The settled dense material is removed by a screw conveyor. Before the material can be discharged onto a belt conveyor, the free water needs to be removed, which is accomplished by static dewatering whilst the material is transported by the screw. Thus, both the removal of grit from the suspension and problem-free transport of the separated material can be performed in one process step. The treated overflow flows by gravity directly into the second stage.

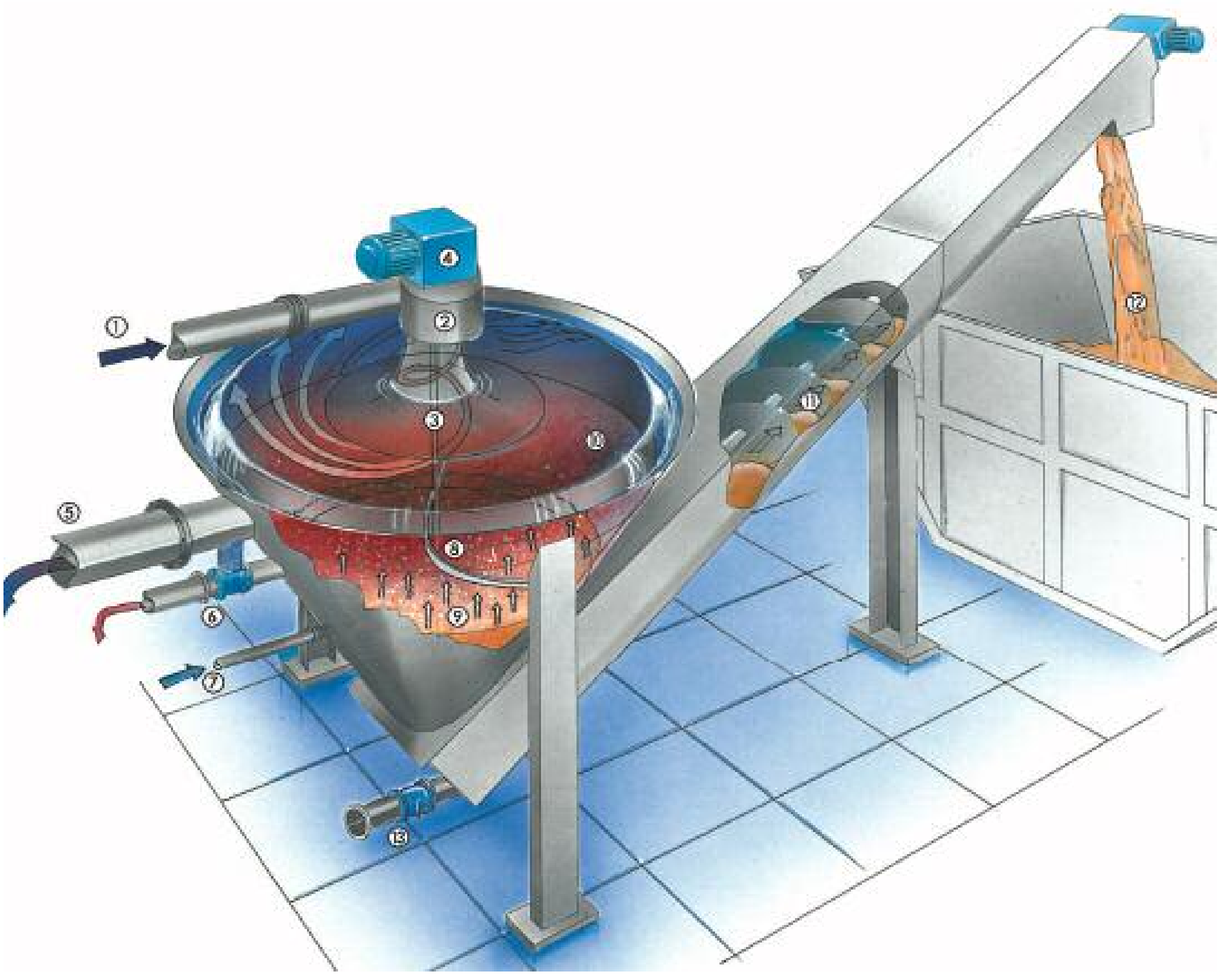

Figure 3 Grit and dense material separation

2.2 Fibre separation

In the second treatment stage fibres and floating material are separated by a HUBER ROTAMAT Ro 2 screen, the design of which is especially adapted to the ISKA® percolation. The percolator water exiting from the grit separator is directly fed into the basket of the ROTAMAT® screen. The screen basket with 1 mm bar spacing reliably retains fibres and floating material. Also the conveyor and transport system for screenings discharge is especially designed for this purpose and dewaters the screenings to a transportable dry substance content. The dewatering process takes place within the compaction zone where a DS in excess of 30% is achieved by means of compaction mechanisms that have especially been adapted to the specific medium. To avoid additional dilution of the percolation water, virtually no clear water is used for screen basket cleaning. Instead, the screen baskets are cleaned with a pressure air system that has been developed by HUBER for especially this purpose. No clear water is required. Only a small part of the effluent from the fibre separator is used for cleaning after a special treatment.

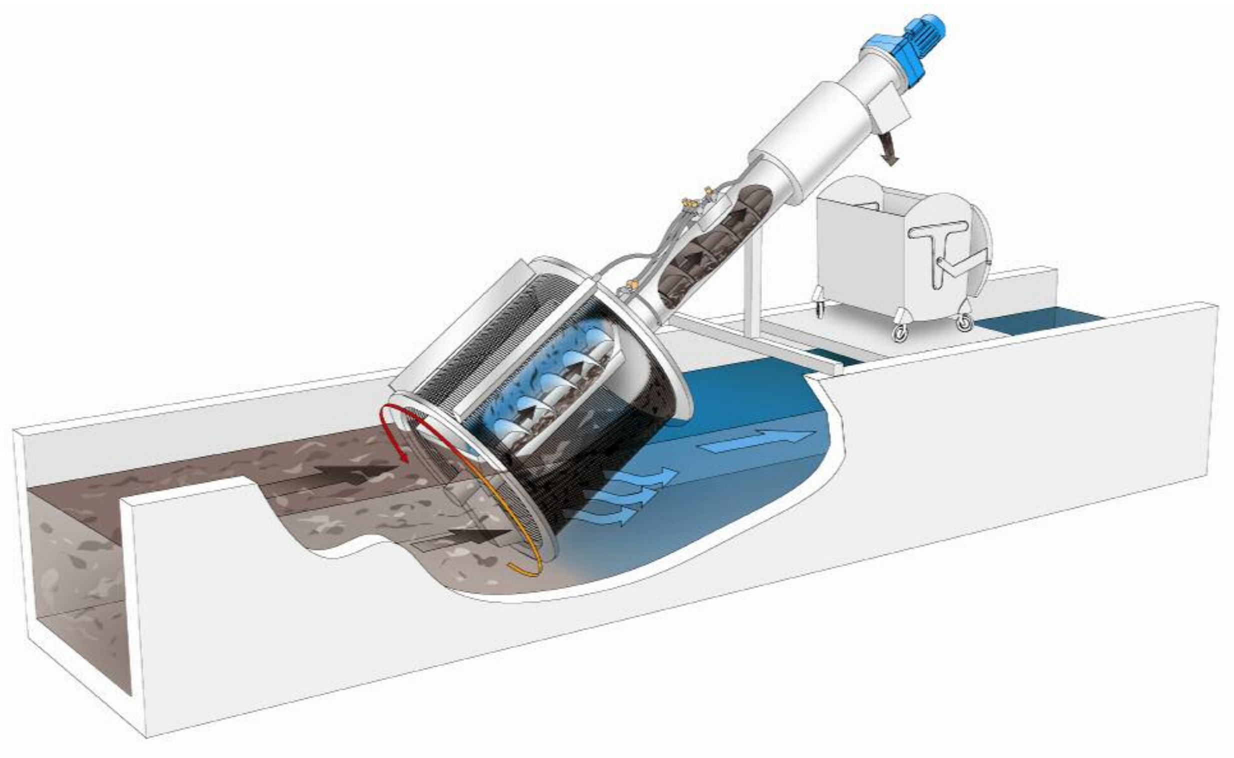

Figure 4 Fibre separator

2.3 Preparation of cleaning water, wash water and upflow water

The cleaning and upflow water required for the entire process is provided in a separate preparation unit. A part of the effluent from the fibre separator is used as upflow for the grit and dense material separator. A constantly high suspension quality is thereby of significant importance. Excessively polluted suspensions would lead to clogging of the upflow nozzles and eventually bring the entire process to a standstill.

To reduce the particle size in the water used for filter surface cleaning, the required amount is screened in a HUBER ROTAMAT RoMesh Screen with 0.5 mm mesh size. Only then the quality is sufficient and suitable to be fed into the special spray nozzle bars.

These two measures eliminate any additional dilution of the fermenter feed. Only internal cycles are required for preparation of cleaning and wash water.

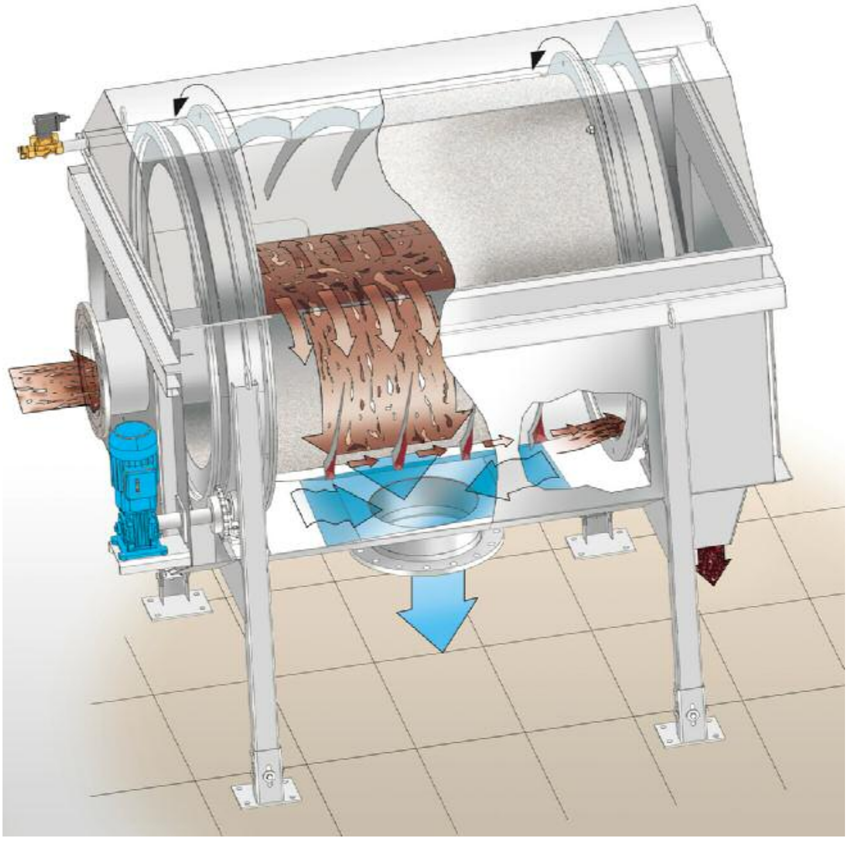

Figure 5 RoMesh Screen

3 Summary

The presented treatment technology can significantly improve the quality of the percolation substrate. Separation of fibres, grit and dense material with HUBER machines significantly reduces the disturbing material load in the subsequent fermentation stages.

4 Literature

ISKA – GMBH 2004 Verfahrensbeschreibungen der Perkolation

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