

COD/BOD₅ Reduction with ROTAMAT® Fine and Micro Screens



Removal of particulate material from wastewater

- Eco-efficient use of capital
- Water pollution control through maximum COD/BOD₅ reduction
- Service water and irrigation water recovery
- Suitable for use in river and sea outfall applications

►► The situation

The protection of our waters (rivers, lakes, seas) for us and our future generations is a challenge we all have to face. Since the budgets available are frequently limited, they have to be spent as efficiently and economically as possible whilst achieving the maximum benefit. This is particularly pertinent in rural areas of developing and emerging countries where the most commonly used worldwide biological wastewater treatment systems of the activated sludge process type are both inefficient and uneconomical.

The disadvantages of such biological wastewater treatment systems are:

- High energy consumption
- Long planning and building phase
- High personnel requirements
- Complex measuring and control equipment
- Large sewage sludge volumes
- Removal of nutrients

The application of biological wastewater treatment systems, as used in industrial countries, is therefore deferred in rural areas of developing and emerging countries.

Mechanical treatment systems, however, are a quick and affordable solution for the removal of undissolved material from wastewater and are therefore frequently used as a first step with the aim to eliminate as much as possible of the particulate material contained within the raw wastewater.

New developments in the field of mechanical wastewater treatment are further able to improve wastewater quality and meet specific requirements through fine and micro screening. The cost-effective and easy to install fine screens within a single process step can remove undegradable toilet and plastic particles along with organic material contained within the wastewater.

As a result, the treated wastewater can be reused, for example as irrigation water containing nutrient.

Further applications for fine screens are river and sea outfalls which frequently have only coarse mechanical screening installed. It will however we feel become increasingly more common and important to reduce the COD/BOD concentration and minimise the oxygen-consuming loads of the wastewater discharged into the receiving water course.

To achieve removal of high oxygen-consuming loads, screening elements with very fine apertures, preferably square mesh, are used. Their two-dimensional design combined with the defined separation size of the square mesh enables an extensive removal of solids to be achieved. In addition the very fine square mesh has a

very large free surface area and is therefore able to cope with high hydraulic capacities.

The BOD₅ reduction of 20 % and filterable solids reduction of 50 % demanded by the North Sea bordering states can be achieved with the use of very fine mesh screens.

In view of this situation, HUBER has developed a range of mechanical treatment solutions which are able to meet the requirements of adapted wastewater treatment. Dependent upon the purpose of use and requested clarification results, HUBER is able to offer several different wastewater treatment systems. The flow diagram on the next page provides an overview of the recently developed solution. The fields of application and potential of the fine screens are explained as follows.



Thousands of tons of screenings within river and sea outfall applications can be removed and disposed of in an eco-friendly way by screening wastewater prior to discharge.



Bahia Blanca, Argentina: Three ROTAMAT® Wedge Section Screens installed in the channel ensure odour-free dewatering and removal of the screenings and significantly improve this river and sea outfall application

►► Ecological-economical aspects

The total ecological benefit achievable with mechanical treatment can be demonstrated when comparing the reduction of oxygen-consuming substances discharged into the receiving water course with the resultant reduction achieved by biological treatment plants, both with the same investment cost of 1 Mio. Euro. (See table below.)

Conclusions

- On the basis of a fixed investment cost, the combination of coarse and fine screening is able to eliminate up to ten times the COD load that is eliminated by a fully biological wastewater treatment plant (related to German standards).

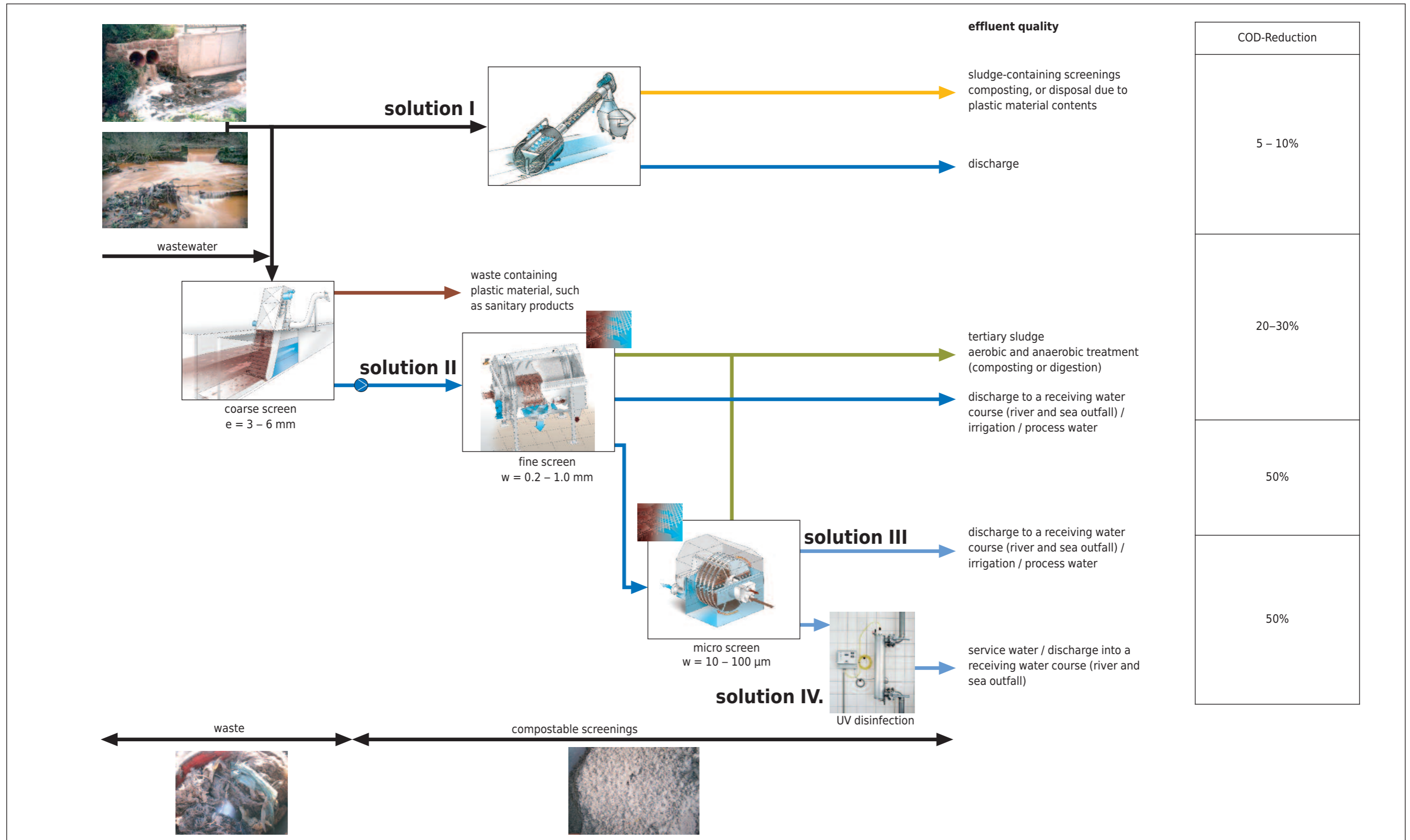
- Region-wide mechanical treatment achieves a higher total elimination of oxygen-consuming substances than partially installed fully biological treatment plants.

Mechanical treatment however provides even more advantages. The systems are easy and quick to implement, allow for installation of several smaller treatment units, and their robust design ensures a long product life, minimum operator attendance, low energy consumption, maintenance requirements and spare parts costs.

Parameter	Unit	Mechanical		Biological
		Fine screening	Fine and micro screening	Biological ww treatment+
PE-specific investment	€ / PE	5	11	200
Connect load	E	214000	93000	5000
COD load	kg O ₂ /d	25680	11160	600
Efficiency	%	20	50	95
Eliminated COD load	kg O ₂ / d	5136	5580	570
Load-specific investment	€ / kgO ₂ / d	195	180	1755

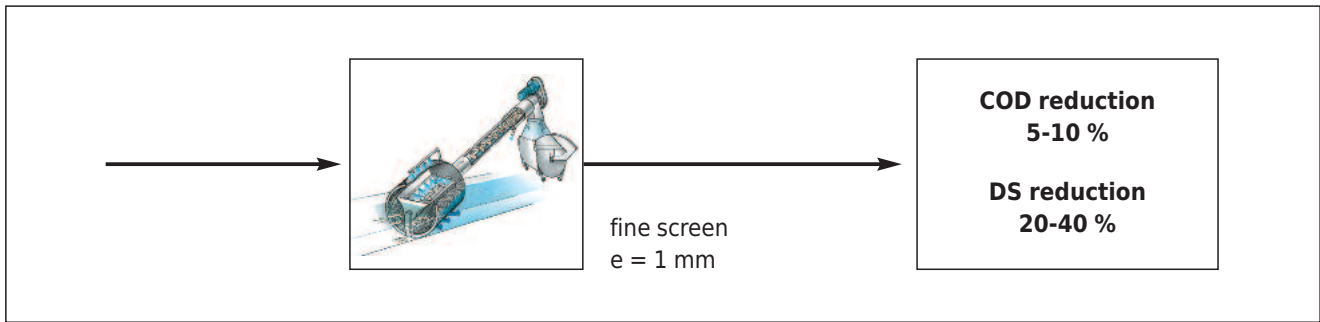
Connect loads and environmental burden reduction achieved with a fixed investment cost of 1 Mio. Euro.

➤ HUBER Solutions for river and sea outfall applications – Mechanical-chemical wastewater treatment systems



Flow diagram: Combination of several treatment methods for further wastewater reuse

➤ River and Sea Outfall: HUBER Solution I



Solution I: Mechanical treatment of raw wastewater

For this purpose the use of fine screens is particularly suited as they reliably eliminate high concentrations of solids and thus oxygen-consuming substances through enforced removal. Fine screens with 1 mm apertures are able to achieve a COD reduction of 5-10 % and a DS reduction of 20-40 %.

The sludge which contains screenings separated from the raw wastewater by the mechanical fine screen is odour-free and discharged into a container. Due to the removal of all plastic material the resultant sludge must be disposed of, or alternatively may be composted after presorting.



Wastewater screening with a 2 mm ROTAMAT® Rotary Drum Fine Screen Ro 2



Outdoor installation of a ROTAMAT® Rotary Drum Fine Screen Ro 2 with insulation

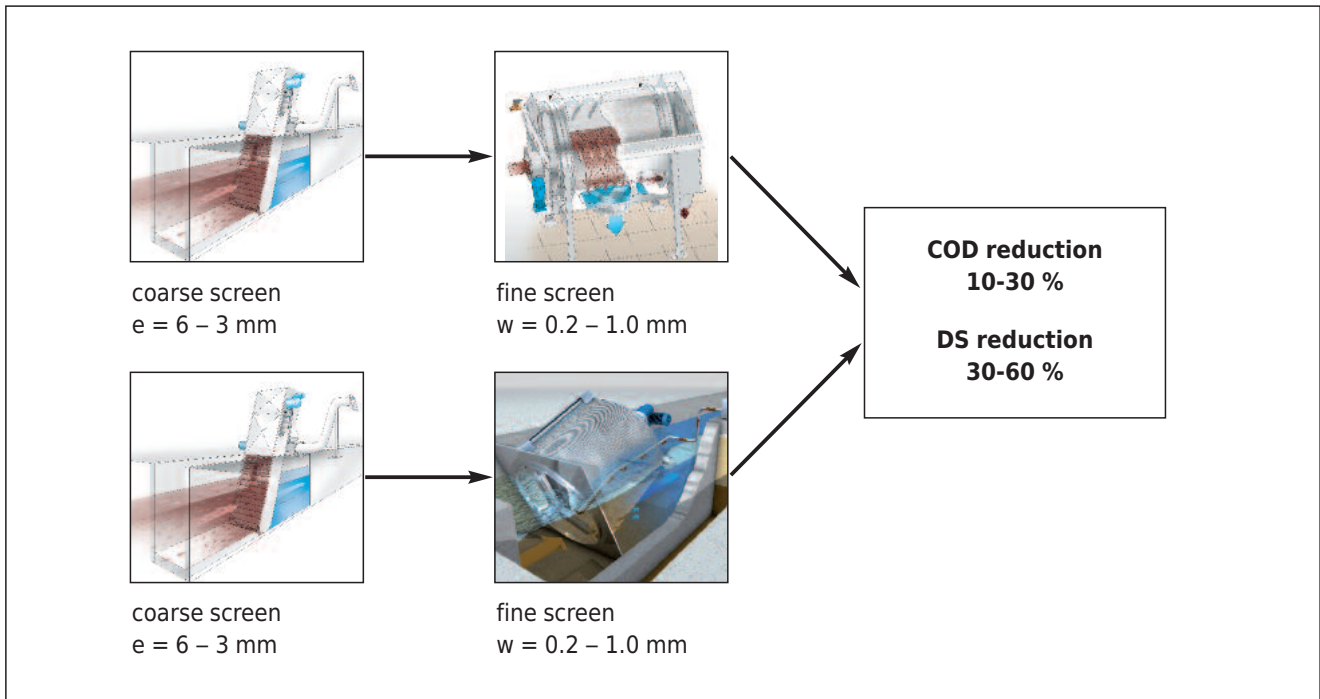


Screened wastewater used for irrigation in arid regions such as Israel after preceding stabilisation in water reservoirs



Irrigation of crops with a hose system

➤ River and sea outfall: HUBER Solution II

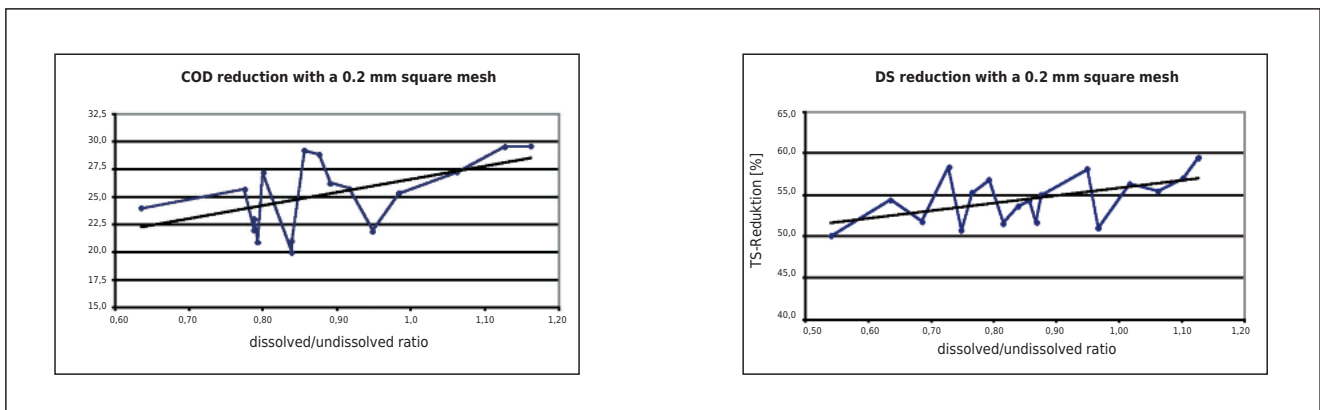


Solution II: Mechanical treatment with combined coarse and fine screening.

With mechanical treatment alone, COD reductions of 10-30 % can be achieved. The preference when using fine screens (ROTAMAT® Membrane Screen RoMem or ROTAMAT® Rotary Drum Screen RoMesh®) is to utilise a square mesh screening medium. With the two-dimensional design, very fine apertures and the defined separation size provided by the square mesh, it will prevent in particular fibres and hairs being washed through the mesh before the screen basket surface is cleaned.

The increased volume of screenings produced proves the high efficiency of square mesh design when compared to wedge wire. The BOD₅ reduction of 20 % and filterable solids reduction of 50 % demanded by the North Sea

bordering states for river and sea outfalls can be achieved with the use of very fine mesh screens. The higher the ratio of undissolved/dissolved COD, the higher will be the separation efficiency as only undissolved substances can be removed without chemicals being added. In drought areas the wastewater containing nutrients can be used for irrigation of flowers and other plants but is not intended for human consumption.



Separation diagrams: COD and DS reduction achieved by a 0.2 mm square mesh screen

Typical separation sizes are 6 – 3 mm for coarse screening and 1.0 – 0.2 mm for fine screening. Automatic periodic high-pressure washing at 120 bar (standard setting: twice a day) eliminates sedimentation on the screen basket (grease, oil). As a filtrate of such quality can be reused for irrigation or as process water, this further treatment process provides a sustainable solution to a further environmental problem.

The use of a ROTAMAT® Membrane Screen RoMem liquid for fine screening permits additional treatment of the sludgy screenings. Due to the special screenings transport by pump fine screenings can be dewatered together with coarse screenings. Such combined dewatering achieves high dewatering results.

Due to the containment of the plastic material (e.g. sanitary products) the sludge separated by the coarse screen only requires disposal, whereas the screenings removed by the fine screen can be composted.



River and sea outfall application: ROTAMAT® Membrane Screen RoMem liquid for wastewater screening



Screenings removal by pump (e.g. eccentric screw pump)



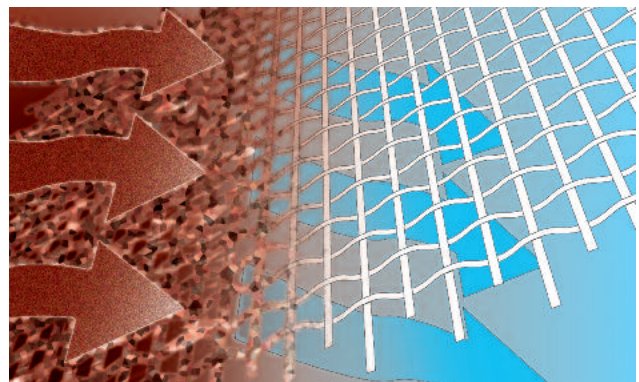
River and sea outfall application: wastewater screening with a ROTAMAT® Rotary Drum Screen RoMesh®



Fine screening with a ROTAMAT® Membrane Screen RoMem ideal for installation in a channel

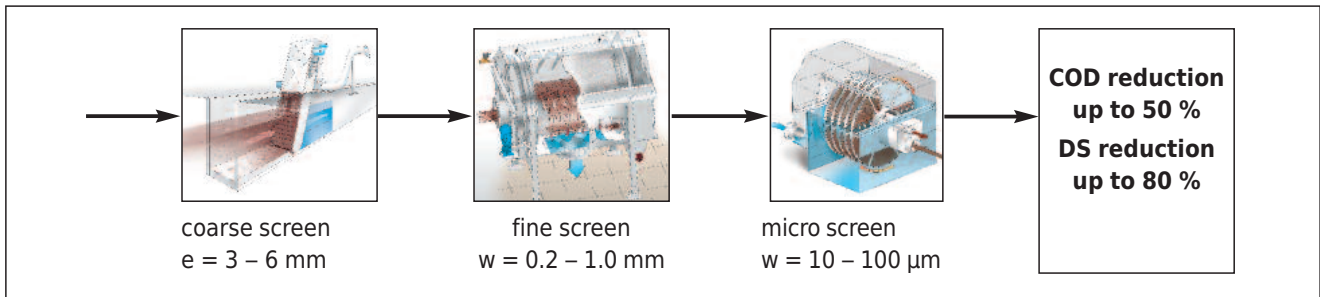


River and sea outfall application in China: 16 ROTAMAT® Rotary Drum Screen RoMesh® units with 0.2 mm square mesh for wastewater treatment



Maximum separation efficiency due to the defined separation size provided by the square mesh

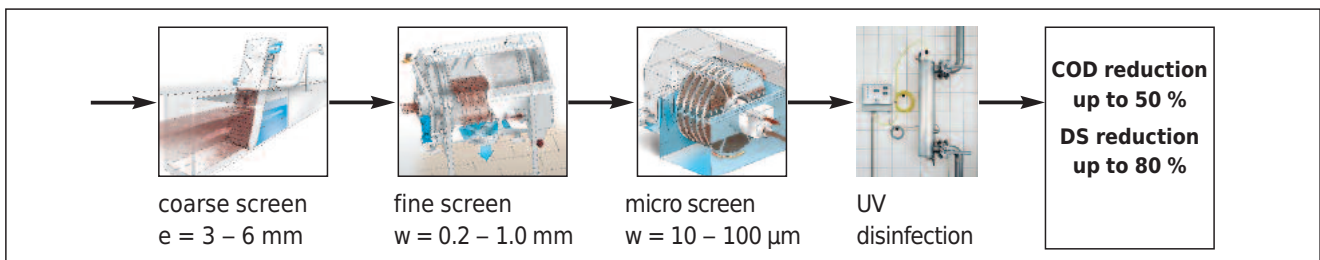
➤ River and sea outfall: HUBER Solution III



Solution III: Wastewater treatment through combined coarse/fine screening and micro screening. This combination is able to significantly reduce COD by 50 % and DS by up to 80 %. The subsequent micro screen produces a virtually solids-free effluent. The high filtrate quality allows for reuse of the effluent as service water, process water, or for irrigation purposes.

The screenings separated by the fine and micro screen are fed into a wash press where they are dewatered, compacted and discharged to allow for further sludge treatment (composting).

➤ River and sea outfall: HUBER Solution IV

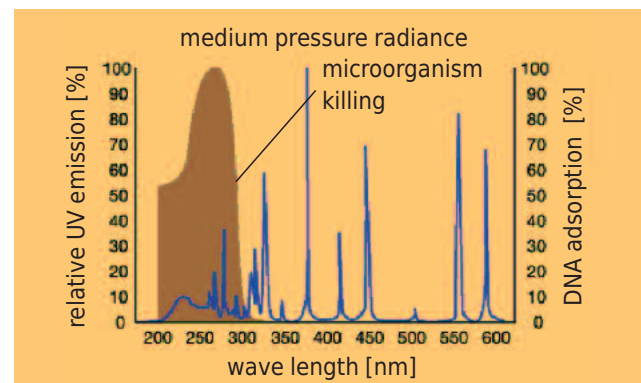


To meet especially high hygienic requirements, UV disinfection is added to the solution III concept and is utilised where the resultant wastewater is to be used for irrigation of crops grown for food production.

UV disinfection plants are utilised when the microbiological requirements are high but chemical disinfection or the use of a membrane plant cannot be applied for cost reasons.



RoDisc® Rotary Mesh Screen for separation of fine suspended material



UV disinfection for high microbiological requirements

►► The user's benefits

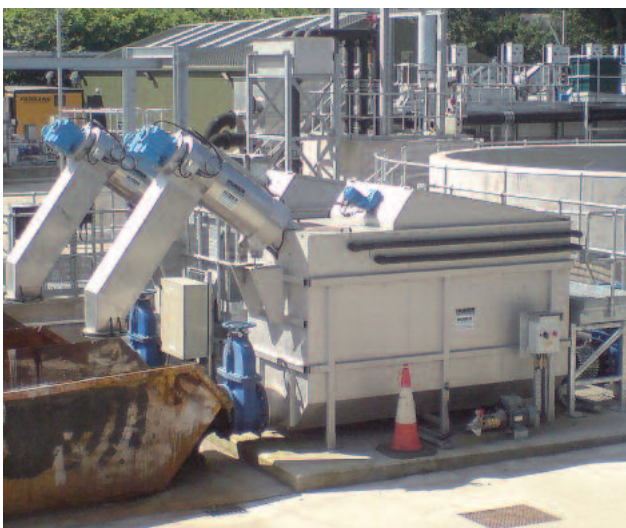
Mechanical treatment stages provide the following benefits for planners and operators:

- Short planning and implementation time
- Small space requirements
- Cost-effective solids removal, high-efficiency COD/BOD₅ reduction
- No need for a preliminary or secondary clarifier
- Odour-free discharge of separated, compacted screenings
- Optional and easy retrofit of a biological treatment stage

►► The applications

The screens can be used for extensive elimination of solids and oxygen-consuming suspended material.

- In river and sea outfall applications for COD/BOD₅ reduction
- In developing countries for region-wide elimination of oxygen-consuming loads
- In stormwater discharges for removal of filterable solids and COD/BOD₅ reduction
- For COD/BOD₅ reduction to protect highly loaded activated sludge plants
- For recovery of irrigation water, phosphorus and nitrogen which can be reused as fertiliser after wastewater screening
- As a retrofit treatment stage for large amounts of wastewater
- Service water recovery



Outdoor installation of ROTAMAT® Membrane Screen RoMem units



Wastewater fine screening with three ROTAMAT® Membrane Screen RoMem units

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COD/BOD₅ reduction with
ROTAMAT® fine and micro screens