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REGENERATION AND UTILISATION ROTARY SYSTEMS OF WASTE TECHNOLOGICAL LIQUIDS

WYKORZYSTANIE UKŁADÓW WIRUJĄCYCH DO REGENARACJI ZANIECZYSZCZONYCH PŁYNÓW TECHNOLOGICZNYCH

Abstract

The article shows prospects of using regeneration and utilisation rotary systems of waste technological liquids in enclosed local water systems.

Keywords: local water systems, waste technological liquids, filtration of disperse solutions.

Streszczenie

W pracy przedstawiono perspektywy wykorzystania układów wirujących do regeneracji zanieczyszczonych płynów technologicznych w zamkniętych, lokalnych systemach

Słowa kluczowe: lokalne systemy wodne, zanieczyszczone płyny technologiczne, filtracja zdyspergowanych roztworów

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1. Introduction

In industry, wastewater is formed in treatment processes of different materials in aqueous media, and its quantitative and qualitative composition significantly varies, depending on the purpose of the implemented process.

When using wastewater as a heat carrier, a decisive influence on the efficiency of the heat recovery is had by such features as its pollution, heat capacity and the volume of abduction. Therefore, an analysis of the above wastewater characteristics in different liquid processes is appropriate.

The problem of material resources reusing, for example, in the manufacture of textile finishing industry is of great importance both from the technical and economic point of view, and to ensure optimal production of ecological interaction with the environment. At the same time, the complex problem is solving not only for the regeneration of waste material of technological solutions, but also for the problem of secondary recovery environments with a significant energy potential, by creating technologies and systems operating in a closed loop.

2. Methods

2.1. Local methods of a wastewater treatment

Numerous studies have shown that the wastewater treatment in chemicals and other types of industries is most effective if they are processing directly in the field of contaminants formation before mixing in wastewater sewers. Wastewater technological equipments for the same type of purposes usually contain a significant amount of the same quality contaminants, whose removal can be performed by one method or by combining them, which is economically efficient for cleaning mixtures. A number of pollutions in the wastewater individual equipment can be so large that their discharge into the sewers and further works general constructions is impossible without special pre-treatment means. Thus, local wastewater treatment uses various mechanical, chemical and physico-chemical methods, and the circulating local sewage systems in a number of cases should be a part of an industrial complex.

2.2. Choice of a local method of a wastewater treatment

A local treatment of concentrated effluents allows to recycle valuable components. However, a prerequisite wastewater before entering it into the overall transportation system for biological treatment facilities should consider the necessity of pre-cleaning and preparation at local wastewater treatment plants. Creating reliable automatic quality control systems largely contributes to the execution of the conditions.

Separating the waste water treatment systems plant-wide and locally eliminates the need for costly construction of long-distance pipelines, reservoirs diameters are reduced, simplified communications and water ways post-treatment.

Concentrated waste water after finishing processes advisable to clean by means of various chemicals and oxidation methods extracting from the wastewater components -

extraction, electrochemical, flotation methods, adsorption, filtration, ultrafiltration. Recent methods on the technological characteristics are the most advanced and promising in terms of both the quality of ultrafiltration and capital, and energy costs for wastewater treatment.

The complex technological scheme of wastewater treatment is based on the following principles:

- creation of independent (local) water circulating in each production system with the necessary local treatment facilities and the subsequent use of treated waste-water in the process;
- separation and disposal of waste liquid technological environments, which may be used in a recycling water management;
- construction of facilities for the advanced treatment of biochemical effluent with the return of all recycled water in the production working cycle.

Concentrated wastewater cleared on local technological units can be taken to the biochemical adsorption or filtration systems for the fullest cleaning and then return to the system of water consumption.

Filtration is one of the methods for separating suspended solids from liquids and gases by means of porous walls or special centrifuges.

3. Decisions

3.1. New trends

Today, the development of a membrane filtration unit, in which in order to create the working pressure, a centrifugal force field will be applied, is the most urgent task. This is caused by the fact that besides installing baromembrane, the membrane elements should include: the pump unit, pre-treatment equipment, tanks for feed solution, the permeate and the concentrate, sensors and automatic control and monitoring devices, connection and control valves, frame elements, etc. Centrifugal filtration units, with the diaphragm, have the following advantages: tens of times less power consumption; considerably less space requirements; mobility in mind the small size; relatively low operating pressures due to low contamination of separation surfaces.

It gives even more advantages to bring together multiple stages of membrane separation into one centrifugal set – the combination of macro and micro-filtration process with ultrafiltration. Therefore, expansion of the application scope of membrane technology can only be achieved at the expense of development work on the creation of new and improved existing spacer elements and devices.

The main objective of the developed local treatment systems and the recycling of technological water is to prevent the discharge of waste water into the environment (into the surrounding water). No less important is the problem of collecting valuable chemical components contained in waste solutions with a view to their re-use.

Creating a multi-stage cleaning system running on the wastewater of the whole enterprise requires significant capital expenditures. In this case, mixing sewage processing equipment after different purposes (different from the chemistry of the process) makes it impossible to extract expensive components from working solutions. These components are

irretrievably lost, and in addition to damage to the environment, they increase the costs for companies to resume raw materials.

Saving technological water and preventing the discharge of waste water to a large extent can be achieved through the use of membrane technology. With it, you can select valuable components from spent wash water and send them for recycling. This method allows to avoid a chemical degradation of component molecules in contrast to the method of evaporation and brought to a state in which it becomes possible to reuse by increasing the concentration.

The most promising is using ultrafiltration membranes that provided a high-speed shared solution on its surface, which leads to the possibility of long-term operation of the filtration equipment without intermediate cleaning. Centrifugal devices, in this case, are a key element to create a local waste treatment system of liquid media technology.

A centrifugal membrane device (Fig. 1), as a part of the system, contains three separate levels: macro, microfiltration and ultrafiltration [1]. Performance of the centrifugal membrane device, according to the starting solution, may be chosen in the installation via separation factor value in accordance with the rotor speed. This scheme provides for the recovery and recycling of chemical components process with sufficiently high concentration, and returns to the washing process line the hot cleaned water, which reduces the cost of heat for its subsequent display.

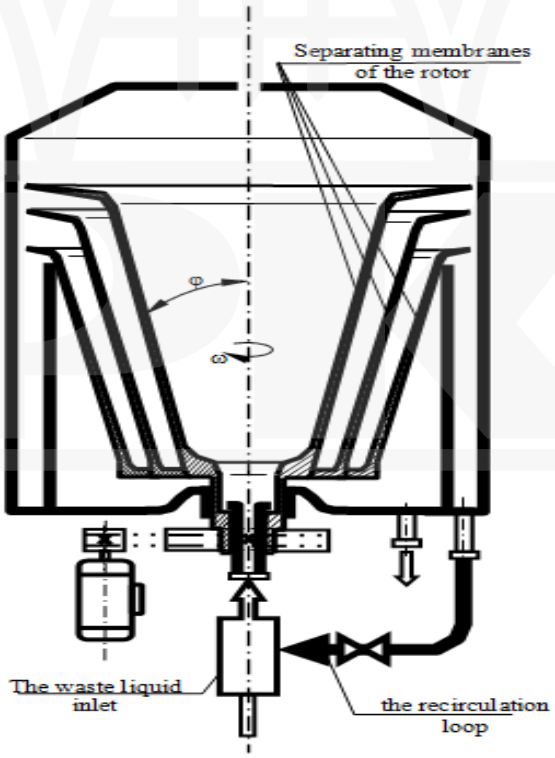

Fig. 1. The design concept of a centrifugal membrane device (CMD)

Equipment of circulating water local system is located directly next to the main process equipment and requires the use of long pipelines and large amounts of storage volume.

Local water recycling system, for example, as a part of the dyeing and drying line, allows achieving the following technical and economic indicators:

- saving technological water, no more than, m^3/h – 6.0;
- saving thermal energy for heating water, no more, Gcal/h (1.3 t/h of normal Pair) – 0.7
- volume reduction of wastewater containing a dye no more than 0.3...0.5 g/l, m^3/h – 6.0.

Thus, the local system of closed water consumption, which included applied centrifugal membrane device, allows to return the purified water effectively into the technological cycle.

3.2. Complete solution

Wastewater of textiles has a high value and high concentration of adsorbed organic halogen compounds as well as intense colour and a significant salt content. Approximately 60% of wastewater in the application of the purification method can be recycled into the production water circulation. The remaining wastewater is treated to such a degree that it can be discharged into the surface water body.

The flow part of the recycled water is desalted by reverse osmosis. Additional demand for industrial water covered by make-up the system of pre-prepared fresh water.

Membrane filtration processes, in particular ultrafiltration and microfiltration, are the separation processes, which take place under pressure using polymeric or porous inorganic materials.

Basic filtration systems consist of two kinds of the same products – filtration devices and filtration modules, which differ mainly by their large-scale indicators (size and weight).

The prospect of the application of multi-stage wastewater treatment system, which comprises: the first stage – pre-cleaning method of macro microfiltration; at the next stage – ultrafiltration separation, realised at higher separation factors (Fig. 2) [2, 3].

4. Conclusions

The possibility of combining all the steps into one system, realised in a centrifugal filtration apparatus, makes it possible to create a highly economical method, implemented on space-saving type of equipment for local systems of circulating water use of technological production.

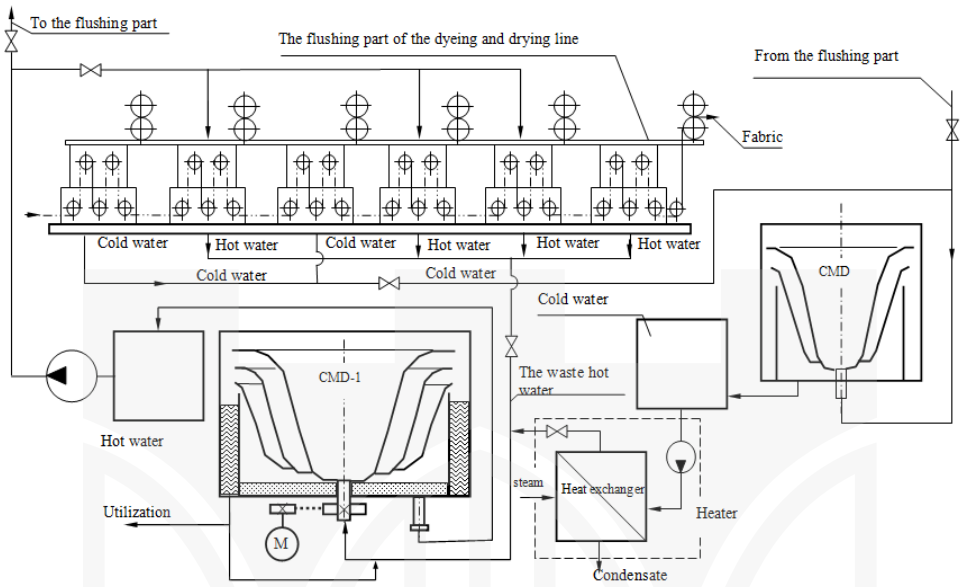

Fig. 2. Technological scheme of the circulating water local system for a dyeing and drying line

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