

12 -TH INTERNATIONAL CONFERENCE “CONTEMPORARY PROBLEMS OF
ARCHITECTURE AND CONSTRUCTION”

Saint Petersburg State University of Architecture and Civil Engineering,
November 25-26, 2020

**AN EFFICIENT TECHNOLOGY FOR
WASTEWATER TREATMENT AND
DESALINATION: CASE STUDY**



**Sahakyan S. V.,
Petevotyan R. A.,
Yedoyan T. V.***

THE AIM OF THE PAPER

The paper aims to suggest the cost effective and environment friendly technology for some industrial wastewater treatment. In this regard main methods of wastewater treatment have been studied and cost efficiency of some desalination method in Armenia have been analyzed.

WASTEWATER TREATMENT MAIN METHODS

- Mechanical treatment - The main processes of which are sedimentation, filtration, flotation, centrifugation, degasification.
- Chemical method - The main processes are oxidation, recovery and neutralization.
- Physico-chemical methods - The main methods are sorption, coagulation, flotation, ion exchange, extrusion, reverse osmosis.
- Biological treatment methods - Are divided into aerobic (trickling filter, oxidizing ponds, lagoons, aerobic assimilation) and anaerobic (anaerobic assimilation, septic tanks, lagoons) methods, depending on the conditions of wastewater treatment.

DESALINATION MAIN METHODS

Presented desalination methods are classified into 3 main groups:

Chemical: ion exchange

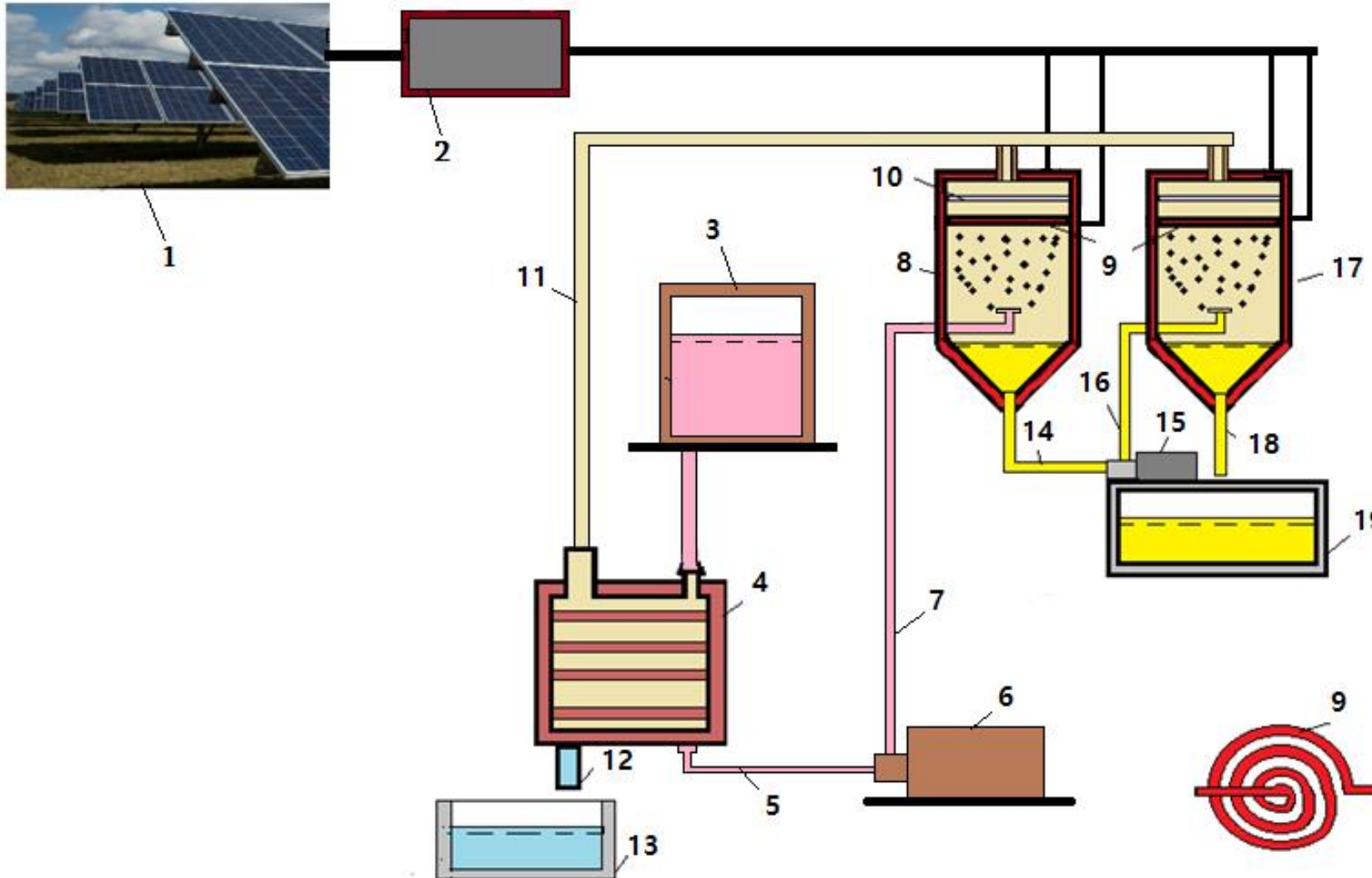
Membrane: electrosarmos, reverse osmosis, electro dialysis

Thermal: extrusion, distillation

COST AND PRODUCTIVITY OF WATER DESALINATION BY DIFFERENT METHODS

Water desalination method	Productivity, m ³ /hour	Clean water discharge,%	Cost (in Armenia), USD per 1 m ³
Ion exchange	5	90	0.84
Electrodialysis	8	90	0.89
Electroosmosis	200	90	0.44
Reverse osmosis	300	90	0.42
Extraction	5	70	0.35
Distillation	15	95	6.00

SKELETON DIAGRAM OF THE PURPOSED WASTEWATER TREATMENT TECHNOLOGY TO OBTAIN CLEAN WATER AND CONCENTRATE



- 1 - solar photovoltaic station
- 2 - accumulator
- 3 - sewage container
- 4 - heat exchanger
- 5, 14 - absorbing pipes
- 6, 15 - pumps
- 7, 11, 12, 16, 18 - pipes
- 8, 17 - dusting chambers
- 9 - spiral closed electric heater
- 10 - grid
- 13 - container for clean water
- 19 - wastewater condensate container

CASE STUDY OF THE PROPOSED TECHNOLOGY APPLICATION FOR INDUSTRIAL WASTEWATER TREATMENT

As a case study, economically efficient and environmentally safe new technology for brandy and wine factory wastewater treatment is suggested, pure water and distillery dreg concentrate production, which will be used in agriculture to improve soil properties and increase fertility.

Although wine production does not have a reputation for polluting industry, these effluents contain large amounts of organic matter, low pH, and variable levels of salinity, which is indicating that these effluents can be environmentally harmful.

Treatment and utilization of this wastewater also incurs significant costs for manufacturers. Thus, the creation of effective and low-cost methods of wastewater treatment is a topical issue.

CASE STUDY OF THE PROPOSED TECHNOLOGY APPLICATION FOR INDUSTRIAL WASTEWATER TREATMENT

The use of distillery dreg as a fertilizer for perennials - grapes and apricot orchards with the norm of 700 t/ha allows to improve the chemical, physical and nutritional regimes of the soil and increase the yield.

However, the cost of transportation is a significant obstacle for distillery dreg usage, as it contains a significant amount of water and transportation is not economically beneficial.

For instance, for the reclamation of one hectare of saline-alkaline soil, 800 rounds of tank cars of 25 tons capacity are required, with an average distance of 30 km. In case of distillery dreg usage as fertilizer, it will be necessary to drive 28 cars of the same capacity.

Among all brandy and wine companies in Armenia, only Yerevan Brandy and Wine Factory, which production is the highest in terms of quantity and quality, is transported the distillery dreg to avoid environmental problems, but in order to reduce huge costs, it is currently given to lands up to 10-15 km away.

CASE STUDY OF THE PROPOSED TECHNOLOGY APPLICATION FOR INDUSTRIAL WASTEWATER TREATMENT

For the transportation of 28.3 thousand m³ of distillery dreg produced annually, it is required 1120 rounds for which USD 35 thousand will be needed. In case of distillery dreg condensation by 5 times with the proposed technological solution, those expenses will make USD 7000 or approximately USD 28000 will be saved annually.

At the same time, with the nutrients containing in 28.3 thousand m³ of distillery dreg, 404 hectares of land can be fertilized, the value of fertilizers is USD 312.5 per ha, or USD 126250 will be received as profit annually.

Expenditures for distillery dreg condensation will be approximately USD 23600. The annual profit will make USD 131000 and at the same time, the ecological balance of the environment will be maintained.

CONCLUSION

- This paper presents a new technology for wastewater treatment, obtaining clean water and concentrate, which is of environmental and agricultural importance. It will allow entrepreneurs of a number of spheres to treat industrial wastewater without economic damage.
- The units used in the proposed technology, unlike other similar technologies, allow not only to increase the productivity of the equipment, but also to return the energy expended through the heat exchanger.
- The effectiveness of the proposed technology is demonstrated by the example of the Yerevan Brandy and Wine Factory. With the use of this technology, the factory complying with all environmental standards can implement industrial wastewater treatment by obtaining distillery dreg concentrate, the sale of which will provide additional income.



THANK YOU FOR YOUR ATTENTION