Master thesis

Implementation of a ZLD unit at an industrial production site

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Abstract

Zero Liquid Discharge (ZLD) has become worldwide spread alternative concept of industrial wastewater treatment and environmental management, which makes possible from the one hand to reuse purified wastewater as process water, thereby significantly reduce fresh water consumption. From the other hand, ZLD assumes absence of outflow, which is usually transformed into solid waste.

The concept of ZLD is well documented and considerable amount of researches have been published on this topic, implementation of new technologies on site is most commonly a challenge for engineers, as well as operation of such plants can be energy consuming.

Implementation of ZLD was studied on the example of the cosmetics industry plant in Kaluga region, Central Russia. The plant has already existing treatment facilities, which include dissolved air flotation, biological treatment in membrane biological reactor (MBR) and one stage of reverse osmosis. Within the framework of ZLD project two additional stages of reverse osmosis and an evaporator were built upon to the existing treatment facilities.

The main objective of the project was to determine whether it is possible to achieve nearly zero discharge under modified treatment facilities, while meeting requirements to process water. During three first months of operation, sampling and chemical analysis of inflows and outflows were carried out. Permeate quality satisfied requirements for recycling water, and 90% wastewater can be recycled.
Determination of operational settings for the 3-stage reverse osmosis under which the whole treatment facilities will work sustainable was the second main goal of the project. High pressure was the main issue during the operation period, RO2 and RO3 yields were adjusted form 85% to 75% and from 65% to 45-50% correspondingly.

Key words: environmental engineering; Zero Liquid Discharge; ZLD; industrial waste water; cosmetic industry; reverse osmosis; RO; evaporator; COD; high pressure membranes; wastewater treatment; salt rejection; mass balance; permeate; concentrate; Russia