

## The Use of Sorbents for the Removal of Selected Anions from Wastewater after Production of Soda Ash

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### ABSTRACT

The research on the use of sorbents to remove anions from the wastewater after soda production was conducted due to the need to protect waters against the pollution at the source of its formation. In the case of industrial plants introducing wastewater to surface waters, this requires modification of the production line or an additional stage of wastewater treatment, which will prevent pollution of the environment. The wastewater generated in the Solvay soda ash production process is characterized by strong alkaline pH, high electrolytic conductivity and high concentrations of chlorides, ammonia, sulfates, phosphates, calcium, potassium, sodium and magnesium. The paper presents the results of the research aimed at removing the chloride, sulfate and phosphate anions from wastewater from calcinated soda production using three sorbents: Halosorb, Kompakt and Damsorb K. The ion removal process was carried out using a dynamic method with a varying deposit load in the range from 0.579 m<sup>3</sup>/(m<sup>2</sup>h) to 1.937 m<sup>3</sup>/(m<sup>2</sup>h). The concentrations of all tested anions were reduced, which indicates a high potential of the method and possibility of further, more detailed studies.

**Keywords:** sorbents, chlorides, sulfates, phosphates, soda ash, wastewater treatment

### INTRODUCTION

The Water Framework Directive forces the EU Member States to protect the water resources from the pollution at its source [7]. In the case of industrial plants, it is necessary to modify the production processes in such a way that they generate as little wastewater as possible, which will have a minimal impact on the condition of the receiver or the introduction of an additional stage of wastewater treatment that will reduce or eliminate the environmental pollution.

The plants dealing in the production of light and heavy soda ash, belonging to chemical industry, are an example of a strong impact on natural waters. The production processes of modern plants are based on the Solvay method, which is associated with the formation of saline waste [12, 14, 16]. In the world, the method of managing the waste from soda plants, which would allow for the complete elimination of ecological damage, has

still not been worked out. The wastewater treatment methods result mainly from local solutions. In Japan, China and India, the post-production waste was partly managed by producing NH<sub>4</sub>Cl used for the rice cultivation. The use of ammonium chloride in Europe would cause acidification of soils; therefore, this solution is excluded [10]. Mostly, agricultural lime is obtained from the waste. The remaining wastewater is directed to the surface waters, while the sludge is collected in the settlers [4, 5]. In a situation where wastewater reaches rivers, the salinity of a receiver may be limited by adjusting the amount of waste discharged to the river states. It can be periodically collected in tanks and emptied at high water levels. Some plants additionally introduce a wastewater neutralization stage by mixing the strongly alkaline wastewater from the production of soda with the acidic wastewater obtained from other production. Other research concerns modification of the production technology and replacement











