SELECTIVITY OF CONCENTRATE COMPOSITION DEPENDING ON THE APPLIED REVERSE OSMOSIS MEMBRANE

Barbara TOMASZEWSKA[1] and Magdalena TYSZER[1]

[1]*AGH – University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, al. Mickiewicza 30, 30-059 Krakow, Poland; mtyszer@agh.edu.pl*

Introduction

Observed in recent years, increase in the use of water resources and consequently fresh water scarcity are one of main global problems during last years. Recently, the rapidly increase in usage of geothermal water resources leads to seek new forms of their management. Worldwide, membrane processes, among others reverse osmosis (RO), are well-known technologies predominatingly applied for providing drinking water, due to high efficiency and relatively low energy consumption (Gude, 2016). Moreover, using membrane processes to desalination and simultaneously to concentrate geothermal waters can provide to gain good quality new product (despite of gaining a permeate used in industry or as fresh water), a concentrate (Sanmartino et al., 2017). Proper selection of process parameters, including membrane selection and recovery values of concentrates (and permeates) will directly influence on its specific compounds, possible reuse and wider management.

Reverse osmosis concentrates are normally treated as waste and depending on its properties (mostly salinity) are disposed to surface waters, sewers, via deep injection, evaporation ponds or land application of concentrate (Bozicek et al., 2017). However recently, RO concentrates are also considered as a valuable sources for production mineral solutions and salts, precious chemicals, including metals and others for different branch of industry, among others cosmetology and balneology. Proper selectivity of reverse osmosis membrane can visibly expand the possible spectrum of use and prepare a concentrate for particular reuse by concentrating selected ingredients.

Samples and methods

The aim of this assay was to examine the influence of used reverse osmosis membrane types on the composition and selective collection of particular ions in gained concentrates by means of reverse osmosis process. The tests were carried out on the example of geothermal water extracted from well located in Poland area. Reverse osmosis processes were conducted in laboratory-scale with the use of four commercially available membranes and have allowed for detailed recognition of the influence of membrane type, in the applied process parameters of RO process, on the selective concentrate composition. The tests were conducted with the use of one-step desalination RO system using the stirred cell device, in the high-pressure version operated in the dead-end mode. The RO processes were carried out at the transmembrane pressure of 15 bar. During the tests, temperature of raw geothermal water was maintained at 22°C by applied heat exchanger. In Figure 1 is presented a schematic diagram of used RO apparatus (Fig. 1).

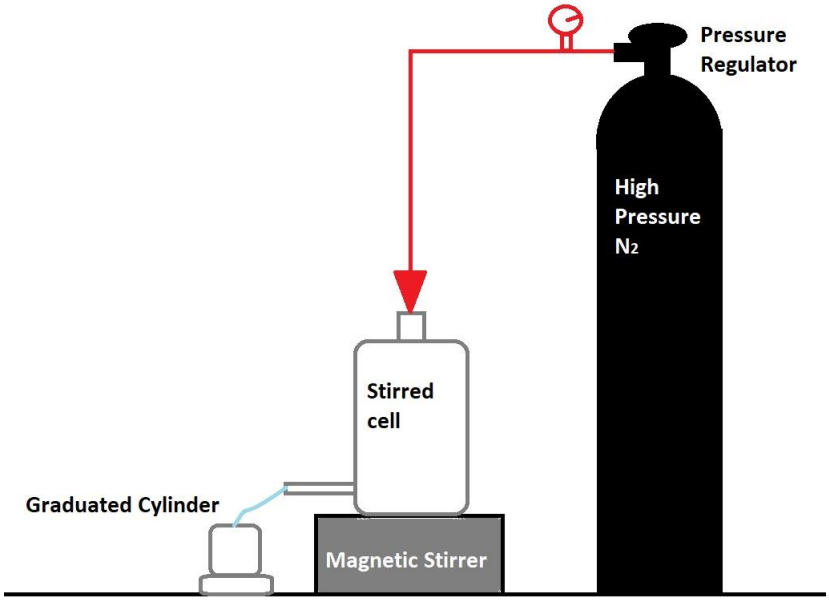

Figure 1. *The scheme of apparatus used in RO processes.*

Results

As a result of the conducted processes, concentrates were obtained, which then were subjected to further tests in order to determine the physicochemical properties of the obtained products. The increase in the mineralization of the tested geothermal water for individual tests ranged from 60% to 65% in relation to raw water. For individual analyzed physicochemical parameters, these values fluctuated significantly and ranged from 10% to more than 98%, depending on the membrane used.

Conclusions

The specific concentration of desired and undesired ingredients will directly affect on the possible reuse in different branch of industry. The results indicated that proper membrane selection allows for greater retention of selected components and, consequently, the adaptation of the product to the desired further use.

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