Pretreatment and desalination of flowback water from the hydraulic fracturing

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ABSTRACT

A process based on pre-treatment and membrane desalination was studied for the treatment of the flowback water from drilling for shale gas in Lubocino in Poland. The effectiveness of pre-treatment technology, which contained NaOH alkalization, KMnO4 oxidation, filtration, sorption, and fine filtration, was studied. Also the usefulness of nanofiltration (NF) and reverse osmosis (RO) membranes for flowback desalination was tested. The study was carried out in the semi-pilot scale. The applied pre-treatment technology made possible to obtain a product that can be placed on the NF and RO elements (turbidity = 0.882 NTU, silt density index = 3.1). The 4040-SR100-N2 NF element was ineffective for flowback water purification, and the retention of contaminants was low (5.1% conductivity, 18.2% total hardness, 9.2% TOC). The AG4040FM RO element was characterized by higher retention (conductivity 93.9%, total hardness 98.3%, TOC 78.1%), but low volume concentration ratio (VCR) (VCR = 1.6) with more than 50% decrease in the permeate flux obtained. The AD-90 RO element was characterized by the highest retention (conductivity 99.3%, total hardness 99.8%, TOC 91.1%), and VCR was 4 by minimal decrease of permeate flux. Proposed pre-treatment technology combined with desalination on AD-90 RO element allows to obtain flowback water reusage. The return of flowback water to the environment requires the application of advanced oxidation to decrease the level of organic contamination.

Keywords: Flowback water; Pre-treatment; Nanofiltration; Reverse osmosis; Desalination

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