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PURIFYING ORGANIC CONTAMINATED MINERAL WATER WITH STRIPPING AND EXPANSION FLOTATION ON MODEL LABORATORY EQUIPMENT

Marjana Penič and Ozim Vojko

Faculty of Technical Science, Department of Chemical Technology, Smetanova 17, Maribor, Slovenia

ABSTRACT

The construction and operation of a model laboratory equipment for stripping and expansion flotation which is needed for water treatment studies is described. The results of stripping and expansion flotation of thermal mineral water from wellboring PT-20 in Petišovci are presented. We can see, that only the pH walue has increased, which is due to the removal of CO_2, whereas the amount of organic substances remained practically unchanged. Flotation yielded some results: about 20 % of potentionaly toxic organic substances were removed, this is still not enough to justify the use of two mentioned procedures in everyday practice.

INTRODUCTION

Thermomineral waters are found also on sites where the Panonic Sea once was. Since the areas were originally intended for oil exploitation, mineral waters found in these well-boring fields are contaminated with paraffins and other organic compounds, such as benzene, xylene, toluene and phenols, which are all toxic. This kind of water is not suitable for bathing without an adequate water treatment system for reducing organic compounds to concentrations acceptable for the human body.

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EXPERIMENTAL

We first tried to clean the thermomineral water from the well-boring PT-20 with stripping and expansion flotation on a model laboratory equipment (figure 1). Air stripping is one of the procedures for reducing the amount of volatile organic substances, especially for separating the volatile paraffins from thermo-mineral water.

Samples were taken directly from the well-boring PT-20. We measured the temperature and the pH value immediately after taking the sample. The temperature and the pH value were measured again in the laboratory at room temperature, as well as redox potential (mV), the m-value (mg/l HCO_3^-), turbidity (NTU), coloring at 254 and 436 nm (m^{-1}), dry residual at 105 °C (mg/l), chemical oxygen demand (mg/l O_2) and the specific conductivity at 20°C (μS/cm) before and after stripping /3/.

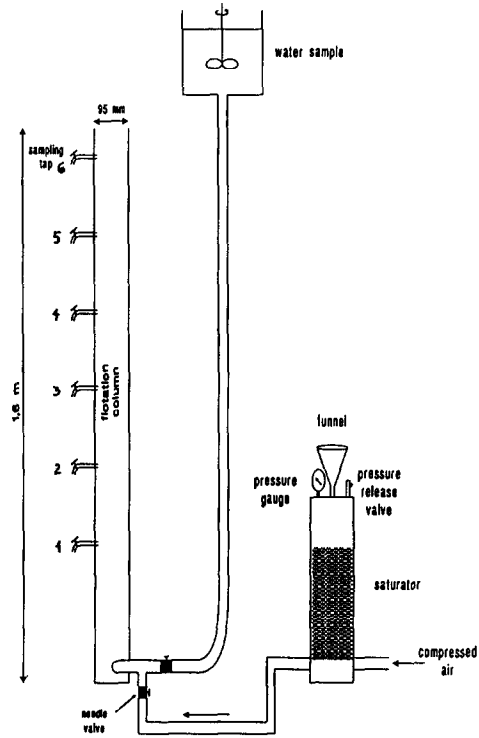

Figure 1: Laboratory equipment for expansion flotation

It was found that only the pH value of water had increased, which is due to the removal of CO_2, whereas the amount of organic substances in water remained practically unchanged, just like all other parameters (figure 2). The best result obtained was the reduction of the chemical oxygen demand from 40,7 mg/l to 38,3 mg/l O_2, i.e. for about 6 %. The other results were worse, therefore we can conclude that stripping was not enough successful.

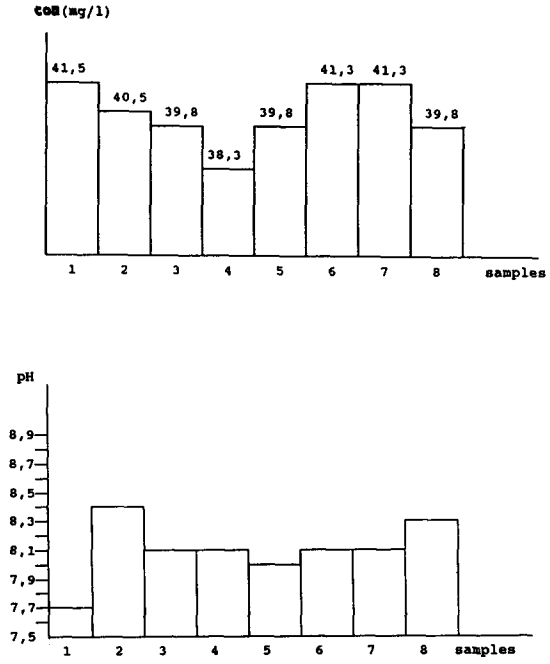

Figure 2: COD and pH in different samples

After stripping we tested expansion flotation. It is a gravity separation process in which air bubbles are attached to solid paraffin particles /1/. The bubble-particle agglomerates have a density lower than water and rise to the surface to accumulate as float. Different methods of producing gas bubbles give rise to

different types of flotation processes: electrolytic flotation, dispersed-air flotation and dissolved-air flotation, where air is dissolved in water under pressure. We used dissolved-air flotation with a saturating pressure of 4 bar

We measured the same parameters as in stripping, before and after the expansion flotation. Optimal achievements are presented in figure 3.

Data for expansion flotation
the air bubbles size = 40 μm
the flotation time = 6 min
air bubbles rising velocity in column = 2 cm/s
the saturation time = 30 min
air - particle agglomerates rising velocity= 0,01 m/s
pressure before expansion = 4 bar

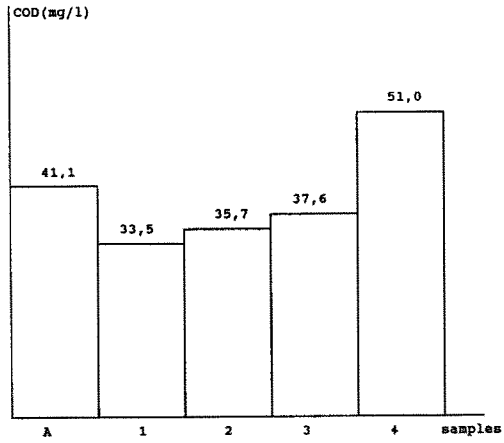

Figure 3: Expansion flotation - optimal achievement

A = sample of mineral water
1 = sample taken from the first column valve
2 = sample taken from the second column valve
3 = sample taken from the third column valve
4 = sample taken from the fourth column valve

We repeated the experiment at different times of water saturation with air, different flotation times and at a higher temperature of 40°C. However, no principal changes were found.

CONCLUSION

Stripping and expansion flotation gave us some interesting results in purifying thermo-mineral water. The amount of organic substances was reduced to about 80 % of starting values by expansion flotation. However, this is still not enough to justify the use of the two mentioned procedures in everyday practice. Therefore, other procedures for reducing organic substances must be tested, such as flocculating before filtering through sand and activated carbon, possibly with or without an adequate ozone treatment.

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