



A multitracer approach for verification of physicochemical parameters of bottled waters in Poland

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Production and consumption of bottled waters are rapidly increasing in many European countries, becoming an important component of their economies. Bottled waters, regardless of their origin, often undergo various treatments including aeration, addition of carbon dioxide, filtration, demineralization and addition of mineral components. The quality of bottled waters is characterized by a set of physicochemical parameters presented on the labels. Independent verification of these parameters in the end-product might become an important element of quality control.

Eight brands of bottled waters from South-Central and Southern Poland were examined over the period of 20 months in order to check agreement of their chemical characteristics (Na^+ , K^+ , Ca^{2+} , Mg^{2+} , bicarbonate, pH) with declared label values and to evaluate their temporal stability. Isotopic analyses were aimed at identification of sources of waters ($\delta^{18}\text{O}$, $\delta^2\text{H}$) and at identification of technological alterations of their CO_2 content ($\delta^{13}\text{C}$ of DIC).

Concentrations of main ions differed from label values for practically all analyzed samples. Chemical compositions reported on bottle labels seem to represent the original composition of well or spring waters. Aeration and filtration result in lowering of Ca^{2+} and Mg^{2+} concentrations. Filtration is probably also responsible for lowering of Na^+ and K^+ concentrations. Deficit of these ions may be also caused by improper salt proportions added to the demineralized water as in the case of one water brand. Two studied waters represent mixtures of two or more components from different wells. In one case results of both chemical and isotopic analyses indicate presence of a highly mineralized component, not listed on the label.

Stable isotope composition of water is not altered during treatment. For all analyzed cases $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values agree with the isotopic compositions of groundwaters for areas where the respective springs and wells are located. For most studied waters $\delta^{13}\text{C}$ of DIC and partial pressures of CO_2 indicated natural origin of DIC inherited from soil CO_2 and modified by the dissolution of rock matrix during infiltration. Three of analyzed waters had high partial pressures of CO_2 and very negative $\delta^{13}\text{C}$ of DIC (about -35 per mill) indicating presence of artificial CO_2 produced by burning of natural gas. One of these low $\delta^{13}\text{C}$ waters was labeled as “non-carbonated” and the purpose of this artificial carbonation was probably to prevent deformation of bottles during transportation and storage. Two other waters from this group were labeled as “saturated with CO_2 to the natural level”. Indeed, their partial pressures of CO_2 were identical to those measured on well heads in the field. Those waters were replenished with artificial CO_2 after removal of dissolved iron through aeration what caused escape of endogenic CO_2 .

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