# **UNIQUENESS OF ADRIATIC SEAWATER**

Danijela Štanfel, Lela Munjas Jurkić JGL d.d., R&D - Analytical Development, Svilno 20, Rijeka, Croatia danijela.stanfel@jgl.hr; lela.munjas@jgl.hr

# **MACROCONSTITUENTS OF** THE SEAWATER

Biological macroelements are well known to be responsible for the functioning of the metabolic processes in the human body. Many of them, such as magnesium, calcium and potassium, are found in seawater and they are proven to be beneficial for human health [1]. They regulate enzyme processes, acid-alkaline changes, blood coagulation, have antidepressant and detoxification properties, balance the blood stream, stimulate muscle activity, influence nerve flexibility, have major role as bone and teeth constituents, and are necessary for the prevention of osteoporosis. Seawater has shown antiseptic, anticatarrhal, trophic, stimulative, antibacterial and antiviral effects. It has been shown that the seawater improves ciliary movement and stimulates regeneration of mucous membrane [2]. Its inhalation increases secretolytic processes, expectoration and spasmolytic activity. Even though we inhale those macroconstituents in small amounts, they have an important preventive and therapeutic effect, especially for upper respiratory tract. Seawater helps in a number of diseases such as rhinitis [3], sinusitis, rhinosinusitis [4], bronchiolitis and upper respiratory tract infections [5], both in children and adults. Consequently, seawater is used for pharmaceutical preparations.

areas with substantial terrigenic contribution by ground or underground freshwater inflow in the sea, and it confirmed it can.

## **OBJECTIVE AND METHODS**

Adriatic Sea represents a rather unique body of water due to its unique geomorphologic specifications and shows higher salinity than ocean seawater. In order to consider potential pharmaceutical use of seawater, our aim was to analyse the content of macroconstituents in seawater of the north-eastern Adriatic sea and in standard synthetic seawater (Sigma Aldrich Fluka) by means of ion chromatography, and to compare it to the content of the ocean seawater determined by Dittmar and recalculated by Lyman and Flemming [6]. The analysed macroconstituents include sodium, potassium, calcium and magnesium ions, which are all proven to have beneficial health effects.

proximately 7-14% higher content of sodium, potassium, calcium and magnesium ions have been found in the seawater of Adriatic Sea compared to oceans, while the Adriatic seawater is much richer (17-24% higher content) in analysed macroconstituents than standard synthetic seawater.

Magnesium ions in Adriatic Sea showed increased content by 7% and 17%, calcium ions by 14% and 21%,

The first systematic analysis of macro-constituents in the open sea seawater (oceans) was conducted **RESULTS** through long-term, precise gravimetric and titrimetric methods, and it is represented as a constant proportion of their concentration called Dittmar's principle. However, our research was designed to investigate whether the composition can differ in

The seawater samples were taken from three locations in Rijeka Bay (Vela Vrata; Bakarski zaljev; Uvala Scott), during three different seasons (March, May, November) in two years and at three depths.

Ion chromatography method was developed in JGL for determination of the macroconstituents in the seawater. Dionex ICS-5000+ ion chromatograph with IonPac CS16 (3x250 mm) column at 40°C has been used with the flow rate of 0.36 ml/min and 35 mM MSA as mobile phase.

and potassium ions by 12% and 24% relative to the ocean and synthetic seawater, which is important as they have prominent role in ciliary movement, mucus regeneration and decreasing local inflamation.

This can be explained by the significant influence of karst freshwater in this region. Adriatic Sea is surrounded by the highest concentration of karst (limestone) in the world which enriches the seawater with minerals.

### CONCLUSION

Our study showed that the seawater of the Adriatic Sea has unique characteristics and is rich in macroconstituents (cations), which makes it superior to ocean and synthetic seawater. Therefore, the seawater from the Adriatic Sea is perfect for pharmaceutical use such as in AQUA MARIS range of products, available throughout the past 20 years.

The research has shown that the time and depth of sampling significantly affect the concentration of analysed ions in the seawater, while the sampling location has the least effect. Samples taken from deeper water are richer in macroconstituents. Ap-



100% prirodan





Open seawater (oceans) North-east Adriatic Sea Synthetic seawater standard

STRONG

**STRONG** 

Figure 1. Mass ratio of Mg<sup>2+</sup>, K<sup>+</sup> and Ca<sup>2+</sup> ions relative to chlorinity in open seawater (oceans), Figure 2. Mass ratio of Na<sup>+</sup> ions relnorth-east Adriatic Sea and synthetic seawater standard.

ative to chlorinity in open seawater (oceans), north-east Adriatic Sea and synthetic seawater standard.

Na<sup>+</sup>

### LITERATURE

[1] Bastier PL, et al. Nasal irrigation: From empiricism to evidence-based medicine. A review. European Annals of Otorhinolaryngology, Head and Neck diseases. 2015: 132 (5), 281-285. [2] Bonnonmet A, Luczka E, Coraux Ch, de Gabory L. Non-diluted seawater enhances nasal ciliary beat frequency and wound repair speed compared to diluted seawater and normal saline.

Ma<sup>2+</sup>

### International Forum of Allergy & Rhinology. 2016: 6 (10), 1062-

1068 [3] IRMWS. Report on the diagnosis and management of rhinitis. Allergy 1994;49 (suppl):1-34. [4] European Academy of Allergology and Clinical Immunolo-

gy. European position paper on rhinosinusitis and nasal polyps. Rhinology 2005;18(1), 1-87.

[5] Kassel JC, King D, Spurling GK. Saline nasal irrigation for acute upper respiratory tract infections. Cochrane Database Syst Rev. 2010 Mar 17;(3), CD006821.

[6] Lyman J, Fleming RH. Composition of sea water. Journal of marine Research, 1940:3, 134-146. [7] Stanfel D. PhD thesis, Comparison of ion chromatography with other methods in seawater analysis of the Adriatic cost,

University of Zagreb, 2006.

nježno AQUA® raspršivanje VARN

**100% PRIRODAN** 

SPREJ ZA NOS

 $30 \,\mathrm{ml}\,\mathrm{e}$ 

na prirodan način odčepljuje nos morska voda

odčepljuje

i čisti

30 ml <del>C</del> 200 doza