Analyze the Balneotherapeutic Properties of Thermal Springs in Poland

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Abstract

The topic of using renewable resources of energy has raised general interest both in Poland and all over the world. Hot springs may be applied in many fields, nevertheless they receive the greatest attention in recreation and treatment. Applied methods and gained curative effects are a good alternative to conventional methods of treatment.
The aim of this thesis is to analyze the balneotherapeutic properties of thermal springs in Poland. Chapter one presents the subject of balneology to aid understanding of the latter parts of the thesis. Chapter two presents issues connected with employing the springs to balneotherapy. The last chapter is a description of health resorts that employ thermal waters. It also shows the analysis of curative and therapeutic properties of thermal waters in Poland on the basis of selected health resorts.

Keywords: thermal springs in Poland, balneology

Geothermal waters

Introduction to balneology

Geothermal energy is a natural energy from the Earth's core which is accumulated in soil, rocks and in rift basins in rocks. It is employed in many different ways. One of them is the direct use of the heat from thermal waters for balneologic and therapeutic purposes [1]. The term balneology refers to one of the oldest branches of spa medicine studying the properties of underground water and their usage in the field of treatment and recreation [2]. The geothermal resources in Poland are located in four main hydrogeothermal provinces, mainly in Polish Plain. Other provinces include Sudetes, Carpathian Foredeep and Carpathians [1].

The history of hot springs

Balneology has been known since antiquity. Romans and Greeks used hot springs for treatment and recreation and for this reason they built thermal baths. In the Middle Ages the Turkish and Arabic people propagated the typical use of thermal baths, later called Turkish baths. The tradition of employing hot springs in Polish health resorts started in the Middle Ages. The first records come from 12th–14th centuries and they refer to the two oldest Polish health resorts, namely Cieplice Śląskie and Lądek Zdrój. The resorts in Ciechocinek and Iwonicz Zdrój have also got a long tradition [3].

Geothermal waters in balneotherapy

The classification of curative and thermal waters

In reference to the classification presented in the Act of 9 June 2011, Polish Geological and Mining Law, The Official Journal of Law no 163, item 981 (Prawo geologiczne i górnicze Dz. U. Nr 163, poz. 981) curative water is the groundwater, which "in terms of chemical and microbiological conditions is not contaminated, is characterized by natural variability of physical and chemical features and contains: dissolved solid minerals – not less than 1 000 mg/dm^3 orb) ferrous ion – not less than 10 mg/dm^3 (ferruginous water), or fluoride ion – not less than 2 mg/dm^3 (fluoridewater), or the iodide ion – not less than 1 mg/dm^3 (iodidewater), or a divalent sulfur – not less than 1 mg/dm^3 (sulfurous waters), or meta-silicic acid – not less than 70 mg/dm^3(water containing silica), or radon -not less than 74 Bq/dm^3 (radon water)" [4].

Geothermal waters, also called thermal waters, are underground waters which are low-mineralized and have a temperature of 20°C. In balneology the classification of waters is based on the comparison of the temperature of human body with the temperature of mineral water. The outcome of these comparisons is the division of waters into hypothermal with the temperature ranging from 20–35°C, isothermal with the temperature ranging from 35–40°C and hyperthermal with the temperature above 40°C [5].

Chemical composition of Polish geothermal waters approved in therapeutics

Curative waters of Poland are located almost in all geological entities. The majority of deposits are

1. Working geothermal heating plant
2. Geothermal heating plant under construction
3. Health resorts which use geothermal waters
4. Geothermal recreational resorts
5. Geothermal recreational resorts under construction

Fig. 1. Location of geothermal facilities in Poland

Rys. 1. Rozmieszczenie źródeł geotermalnych w Polsce

located in the south of Poland in Sudetes, Fore-Carpathians and Carpathians. Polish waters are mainly sodium chloride, radon or fluoride waters. The components of water approved by medicine as useful in therapeutics are iron, iodine, bromine, fluoride, hydrogen sulfide, boron, carbon dioxide, radon and silica. In other countries waters contain also lithium, barium, strontium and radium [6].

Illnesses cured with water therapy

Spa medicine uses many methods and treatments to cure patients. Spa farms offer, among others, treatments by means of water (balneotherapy, hydrotherapy), peat, herbs and also treatments that involve hot or cold water or massage through moving water movement. Mineral baths are the most popular and appreciated treatments in spas. They can act locally or generally and have relaxating, analgesic or anti-inflammatory effect. During the bath session the minerals in the water are absorbed through the patients' skin. Human skin easily absorbs CO_2, H_2S and radon. Many different types of curative waters are used in the baths [7]. Below there is a characteristics of four major types of mineral baths together with diseases treated with these water therapies.

Minera sodium chloride waters are used in brine baths. Apart from sodium chlorine the waters include bromine, iodine and iron ions. Brine baths may also be connected with simultaneous physical activity in the pool. Owing to its anti-inflammatory, bacteriostatic and mucotylic properties they are used to alleviate and eliminate diseases of locomotor system (orthopaedic injuries), neurological, gynaegological, dermatological (for example acne, psoriasis). They also aid weight reduction and fat burning and improve skin condition increasing its moisture, firmness, elasticity and blood supply [8].

Sulphur baths use sulphur hydrogen sulphide waters which contain various forms compounds of sulphur. The active ingredient is the sulfide ion which plays a key role in protection of tissues against damage caused by inflammatory processes, influences the blood coagulation and prevents damage of blood vessels. This kind of baths is recommended for patients suffering from spinal degeneration, rheumatism, after operations of joints or of locomotory system. It is also beneficial in skin diseases like acne, psoriasis and diseases connected with peripheral circulation. The waters may be also be drank by the patients. It is advisable to drink them to treat diseases of digestive system, respiratory system and problems connected with low metabolic rate. They also detoxify the body after heavy metal poisoning like lead [9].

Carbonic acid baths are characterized by the presence of carbon dioxide in water. During the bath the

Tab. 1. Types and locations of curative mineral waters in Poland

Tab. 1. Typy i lokalizacje wód mineralnych leczniczych w Polsce

Type and chemical composition	Location
Sodium - chloride	
Chlorides, potassium, calcium, magnesium, iodies, bromide, iron, sulphur	Ciechocinek, Kołobrzeg, Połczyn, Kamień Pom., Świnoujście, Goczałkowice, Rabka, Busko, Solec, Iwonicz, Rymanów, Wieniec
Hydrogencarbonate	
Sodium, potassium, calcium, magnesium,sodium – chloride, iron	Krynica, Polanica, Kudowa, Muszyna, Duszniki, Rymanów, Iwonicz, Długopole, Czerniawa, Szczawno, Szczawnica, Wysowa, Żegiestów, Świeradów
Sulphide - sulphur	
Sulphur, sulphate - chloride, calcium,sulphate - sodium, sodium, bromide, iodies	Busko, Solec, Przerzeczyn, Wieniec, Swoszowice, Horyniec, Wapienne, Kudowa, Lądek, Duszniki, Ciechocinek
Radon	
Sulphur - radon, fluoride, oxalic, radon	Świeradów, Czerniawa, Lądek
Thermal	
Sodium - chloride, radon, fluoride	Cieplice, Lądek, Ciechocinek, Podhale i in.

dissociated carbon dioxide is released and absorbed either by skin or by the respiratory system, depending on the chosen kind of bath. This kind of bath is recommended especially to patients suffering from diabetes. The treatment improves the blood supply in lower limb and decreases blood sugar. The therapy employing carbonic acid waters are destined primarily for rheumatism, heart diseases, ischaemia of lower and upper limbs, problems with blood pressure and neurosis. The treatment is carried out in a bathtub in a position which prevents the patient from making rapid movements. The patient's head should be raised high in order to prevent inhaling of CO_2 gathered above the surface of the water [9].

Radon baths use isotope 222Rn, the agent dissociated in radon waters that has curative properties. [11]. Water containing radon has fast and intense curative properties. Ionizing radiation easily enters the body through skin or mucous membrane. The greatest amount of radiation enters through the respiratory system. For this reason taking radon baths should be reasonable. Radon baths are used to treat rheumatism, gynaegological and respiratory diseases as well as cardiovascular diseases [9].

Balneotherapeutic properties of thermal springs in Poland

Health resorts which employ thermal springs

Geothermal waters constitute nearly half of all mineral spring resources found in Poland. They present physical and chemical features characteristic of curative waters. Thermal waters are the basis of spa treatments in Cieplice Śląskie, Lądek Zdrój, Ciechocinek, Ustroń, Iwonicz and many others. Balneotherapeutic properties are used in 10 health resorts and 8 resorts of recreational and health character. The recreational and health resorts which employ geothermal waters are located in Zakopane, Mszczonów, Poddębice and Bukowina Tatrzańska [1]. Figure 1 presents the location of existing geothermal facilities and also of those being under construction [10].

Curative and therapeutic properties of thermal waters in Poland illustrated with an example of selected health resorts

The waters of the oldest Polish health resort in Cieplice are characterised by uniform chemical composition throughout the whole sample. They are thermal waters having SO_4-HCO_3-Na+F in its composition and overall mineralization not exceeding 620 mg/dm^3. Geothermal waters of Cieplice Śląskie owe their curative properties to its high temperature of over 86°C , weak alkaline reaction and specific chemical composition- fluorine and silicon. Compared with other Polish health re-

sorts Cieplice is characterised by the highest silica content [11].

Thermal waters of health resort in Lądek Zdrój are useful for treatments because of its high temperature of 20–44°C and overall mineralization of 164–200 mg/dm^3. The chemical composition includes fluorides in the amount of 9,2–10,5 mg/dm^3 and sulphides in the concentration ranging from 2 to 5 mg/dm^3 [12]. Types and locations of curative mineral waters in Poland presented in table 1 [11].

The Podhale region is a prospective area to use geothermal waters for balnotherapy. Their curative properties are the result of its high temperature and specific chemical composition. In the Podhale there are five facilities of recreational and balnotherapeutic character, whose waters have excellent curative properties. The temperature of water in swimming pools of the Podhale ranges from 30-38°C. The waters of thermal springs have varied physical and chemical composition. Its important mineral ingredients are sulphur, potassium, iron, sodium, calcium and magnesium [3].

Closing remarks

Poland is a country, where the conditions for the development of geothermal energy are excellent. We possess rich resources of thermal waters located on the territory of our country. The greatest resources are located in the area of Polish Plain in Grudziadz-Warsaw Region. In Poland there are 8 facilities of recreational and balnotherapeutic character which use hot springs, five of which are located in the Podhale region.

Appropriate temperature and mineralization of geothermal waters cause that they may be used in some branches of health resort medicine, namely in balneology, rehabilitation and treatment of rheumatic, neurological, muscle and locomotor system diseases. Their chemical composition, on the other hand, that is hydrogen sulfide, silica, fluorine and radon have great significance in the treatment of dermatological, respiratory system, urinary system or gynaecological diseases.

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Analiza właściwości balneoterapeutycznych wód termalnych Polski

Temat wykorzystania odnawialnych źródeł energii cieszy się dużym zainteresowaniem w Polsce jak i na całym świeci. Zagospodarowanie gorących wód jest możliwe w wielu dziedzinach jednak zdecydowanie największe zainteresowanie wykorzystaniem wód termalnych, ukierunkowane jest na cele rekreacyjno-lecznicze. Stosowane metody oraz uzyskiwane dzięki nim efekty lecznicze stanowią bardzo dobrą alternatywę dla konwencjonalnych metod leczenia.

Celem niniejszej pracy jest przeprowadzenie analizy właściwości balneoterapeutycznych wód termalnych Polski. W pierwszym rozdziale dla lepszego zobrazowania i zrozumienia pozostałych części pracy, przedstawiony zostanie ogólny zarys tematu balneologia. Rozdział drugi zobrazuje zagadnienia związane z wykorzystaniem wód do celów balneoterapeutycznych. Otrzymamy dane odnoszące się m.in. do składu chemicznego wód termalnych oraz chorób leczonych terapią wodną. Ostatni rozdział zawierać będzie opis uzdrowisk wykorzystujących wody termalne. Przedstawiona zostanie także analiza właściwości leczniczych i terapeutycznych wód termalnych Polski na podstawie wybranych uzdrowisk.

Słowa kluczowe: źródła termalne w Polsce, balneoterapia