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GIG & NEW TECHNOLOGIES

Technology of mine water treatment from radium isotopes

Application

Radioactive elements, such as radium, occur commonly in nature. Therefore, they are located in the rock mass, from which they are washed out and dissolved by saline mine waters, and these in turn pumped out from underground excavations to the surface and when discharged into the environment can cause both contamination of surface waters and the formation of solid waste. The necessity to treat mine water discharged into the environment was obvious even without the regulations introduced lately. The installations for this purpose originated under the auspices of the Central Mining Institute in the mines Piast and Ziemowit already in the last century - the first one in 1999 and the next one in 2006.

Until the end of 2016, scientists conducted intensive research using a pilot installation, which was launched at the Ziemowit mine in Lędziny, analyzing the effectiveness of mine water treatment using zeolites. The effects turned out to be very promising, and the development potential of the project was enormous. Researchers estimate that this technology will be successfully used for the treatment of waters with elevated concentrations of natural radionuclides in other sectors of the economy, such as copper mines or oil and gas mining, where also radium-sulphate waters are found. Similar installations can also be used to treat drinking water from underground water intakes, in water treatment stations intended for consumption, as well as to treat thermal waters or brines in spas and will enable a significant reduction in radium disposal costs.

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Technology using a barium chloride solution

Technology description

In 1999, in a Polish mine, a radium water treatment system was implemented in underground excavations using powdered barium chloride. The method of radium isotope removal from mine water was developed in GIG and a patent was obtained in 1996. In 2006, radium water treatment technology was implemented in another coal mine. In recent years, a new piece of technology has been developed, based on the use of barium chloride solution combined with a system for removing suspended solids from mine waters. Laboratory tests which fully confirmed the effectiveness of this technology were carried out in 2015 at the Silesian Centre for Environmental Radioactivity (GIG). The results of the measurements show the effectiveness of radium isotope removal, at a level of 90%.

The advantages of this technology

One advantage is the high selectivity and efficiency of radium removal from mine water, regardless of its salinity and other chemical composition parameters. A further advantage is the possibility of the full automation of the solution dispensing process, which reduces risk for people operating the installation.

Technology using a mixture of natural and synthetic zeolites

Technology description

Barium chloride cannot be used everywhere for radium isotope removal from waters, especially in cases where purification has to be carried out on the surface. Research on an alternative method of the purification of waters of natural radionuclides using zeolites was conducted as part of the NCBiR PBS2 program within the framework of the RATZEO project. During the years 2014/2017 laboratory tests were carried out on the possibility of adopting a technology using zeolites to remove radium. Moreover, a purification installation was designed and constructed in the area of surface sedimentation ponds of one of the mines. This research confirmed the effectiveness of the proposed technology.

The advantages of this technology

High purification efficiency and the selectivity of the method does not increase the radiation risk for staff and other individuals. The method is passive, so it does not require constant supervision.

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