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Original Research Article

Application of microwave radiation in innovative process of neutralising asbestos-containing wastes

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ABSTRACT

Presented are results of a research on a possibility to use innovative microwave heating for thermal neutralisation of asbestos-containing wastes. In comparison to traditional heating, the innovative process is characterised by up to a hundred times reduced energy consumption and two hundred times shorter processing time. Parameters of effective disposal, i.e. microwave radiation power and heating time, as well as kind and quantity of the wetting agent necessary in the microwave heating process that intensifies the process and ensures uniform heat distribution in the heated charges, were determined for five most commonly used products containing various fractions of asbestos fibres. It was demonstrated that the presented innovative and eco-minded technology of disposing asbestos-containing materials is a quick, cheap, economical and effective solution guaranteeing complete degradation of the hazardous fibres.

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1. Introduction

In legal records, waste management is present in both international agreements and, obviously, in domestic regulations (e.g. in acts of parliament). The basic act that regulates waste treatment is the Act on Waste and, in relation to their origin and to use of a manufacturing system, applied are regulations contained in the Environmental Law.

It is written in the act on hazardous wastes: “principles of waste treatment in the way guaranteeing protection of human life and health, as well as environmental protection, and in

particular principles of preventing creation of wastes negatively affecting the environment and principles of their recycling or neutralisation” [1]. Then, the basic task of the “Waste management” is the action related to the process of collection, displacement, recycling and neutralisation of wastes. Effectiveness of such action, especially in the case of extremely dangerous wastes, is decided by the principles of vicinity, selective collection, recycling or neutralisation in specialised installations or facilities. The materials being an example of a particularly hazardous waste are asbestos-containing products. As a result of specific physico-chemical properties of asbestos, it has found very extensive application,

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first of all in building and power industries, transport, machine-building, shipbuilding, textile, chemical and other industries in form of ca. 3000 diverse products. Notices about harmfulness of asbestos appeared in public very long ago. Observed was increased number of cases of pulmonary diseases among the persons who had to do with this material, while they were both miners and those working at processing asbestos. However, looking through the prism of unusual properties, nobody wanted to believe definitely in its lethal action. However, finally confirmed was the fact, obvious for many people for a longer time, that asbestos is hazardous for living organisms and its use in mass scale should be stopped as far as possible [2-4]. The well-known harmfulness of asbestos is at the bottom of introducing in Poland the "Act on the prohibition of applying articles containing asbestos" that is the key statute in the field of asbestos management. Its consequence was prohibition of manufacturing, processing and trading asbestos and asbestos-containing products. The information received from regional offices about kind,

quantity and occurring places of the asbestos-containing products indicates that ca. 14.5 mln mt of them are present in the territory of Poland. So, the issue of complete, quick, effective and cheap disposal of the asbestos-containing materials becomes extremely important. Possibility of using microwaves for this purpose is decided by their specific properties that, from the viewpoint of this work, permit thermal degradation of hazardous materials [5,6]. It is well known that microwaves with frequency of 2.45 GHz are widely used in industrial heating processes (e.g. drying). In comparison to the traditional process, energy consumption at microwave heating is ca. 10 or even 100 times lower and the processing time is 10 to 200 times shorter [7]. So, the microwave technology can be successfully used for thermal neutralisation of dangerous wastes and of particular interest can be its innovative application for neutralising asbestos-containing wastes [8]. In comparison to variable thermal methods, this technology is distinguished by the fact that there is no combustion but energy-saving controlled heating of

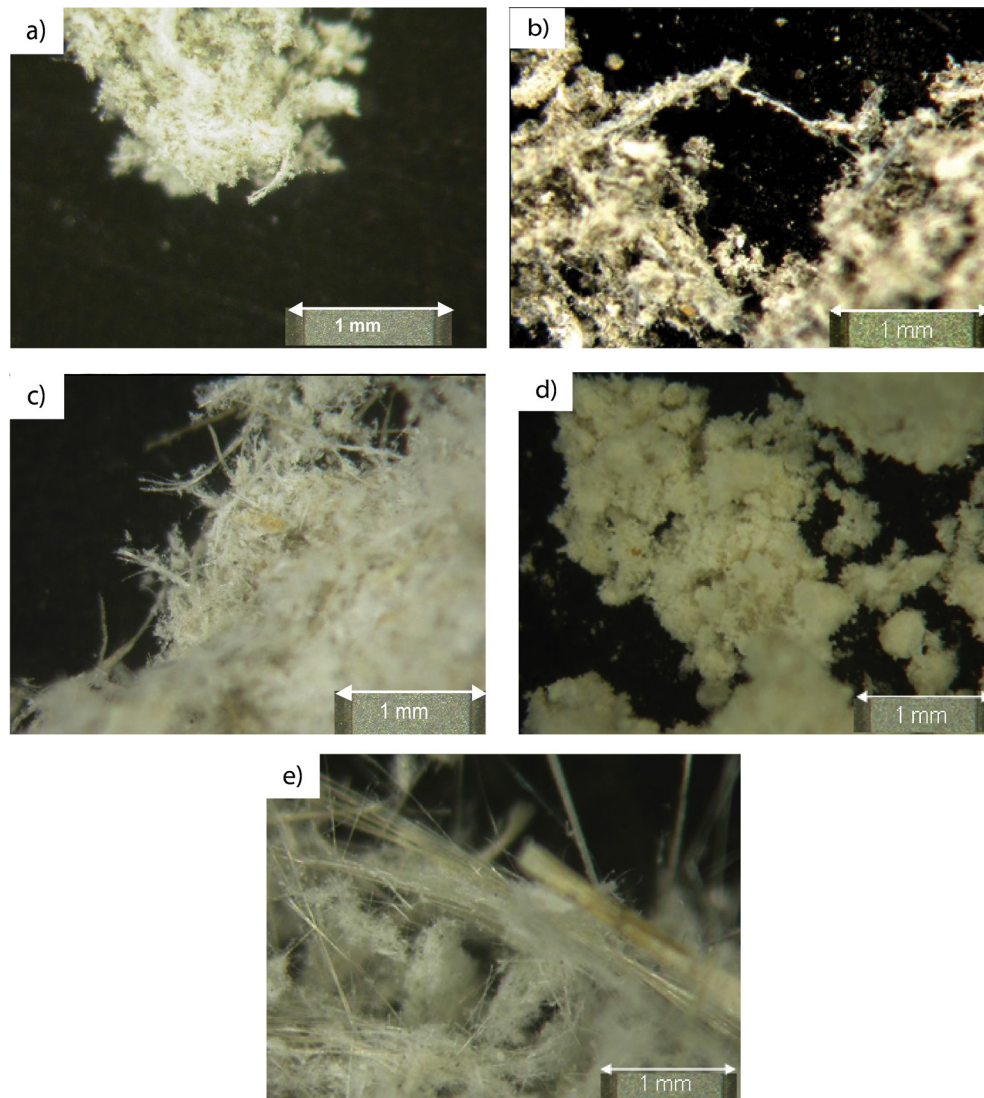


Fig. 1 – View of examined materials: (a) Cement panel, (b) Cement shingle, (c) Panocell, (d) Plaster progypsol, and (e) Sprayed coating.

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