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Matej Baláž

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Ball milling of eggshell waste as a green and sustainable approach: A review

Matej Baláž

Department of Mechanochemistry, Institute of Geotechnics, Slovak Academy of Sciences, Watsonova 45, 04001 Košice, Slovakia

**e-mail: balazm@saske.sk*

Abstract

Eggshell waste belongs to the most abundant natural waste in nature and is created in huge amounts by everyday consumption of eggs. The majority of this material is being discarded, despite the fact that it has multidisciplinary applications. In this review, the possibility of utilization the method of ball milling to further broaden the application potential of this material is discussed. The particular application fields include the formation of nanophases, bioceramics synthesis, formation of composites and preparation of material with increased sorption ability. In addition, some other specific applications, like the utilization of ball-milled eggshell as a drug delivery agent, or for the formation of antibacterially active species, are also mentioned. The review provides a critical mechanochemical insight into this topic and aims to emphasize the green and sustainable way of utilizing eggshell waste by environmentally friendly method.

Keywords: eggshell waste; ball milling; nanophases; bioceramics; composites; sorbent

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1. Introduction

Eggshell waste belongs to the most abundant waste produced by food industry [1]. According to Palka, its world production is 50000 tonnes a year [2]. Therefore, it definitely deserves the attention of the scientific world. In addition to this, it is a unique natural biomaterial with fascinating structures [3], which offers rich plethora of possibilities of utilization. This application potential can be even broadened by its further treatment.

The method of ball milling as a tool of mechanochemistry is an expanding branch of chemistry these days [4-9]. Ball milling of natural materials offers the possibility to bring their application potential to a new level.

The utilization of ball milling to modify the properties of eggshell waste or to prepare novel materials is the focus of many scientific studies these days (Fig. 1a). There is an ascending trend in the amount of papers on this topic, which can be divided into groups, depending on the application area of the final product (Fig. 1b). This review aims to review the most relevant papers in which eggshell waste was ball-milled in order to achieve a specific scientific goal.

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