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A review on magnesium ferrite nanostructure materials: Energy, environment, electronics and biomedical applications

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Introduction: Ferrite constituents are prospective contenders for recent scientific applications because of its adjustable electrical & magnetic properties (1). Magnesium ferrite ($Mg^{2+}Fe^{3+}O_4$) is a significant magnetic oxide with cubic gathering of n-spinel ferrite (2, 3). Among spinel ferrites, $MgFe_2O_4$ is soft magnetic n-type semiconducting quantifiable (4). The unique and distinctive properties of magnesium ferrite find several applications in sensors, fuel cell, waste water treatment, heterogeneous catalysis, oil paint, adsorption and biomedical applications (5). This review significantly focused on the current improvement in $MgFe_2O_4$ based nano ferrites / composites / doped quantifiable for the submission in the energy, environment, electronics & biological application.

Applications of $MgFe_2O_4$ nanostructure materials: The energy is the greatest substantial requirement in today's life, and nothing is possible without it and its impact can be realized by viewing the energy requirement in our everyday life. The energy obtained may be from renewable/non-renewable sources. The global data of 2015 estimated energy demand is fulfilled 76.3% by fossil fuels, 16.6 % by hydel energy, 3.7% by wind energy, 2 % by biomass and 1.2% by solar PV (Photovoltaic) cell (6). The use of nonrenewable energy sources results in the highest greenhouse gas emissions, with the electricity sector emitting 30% and various modes of transportation emitting 26% (7). The best alternative is using renewable source of energy to minimize the greenhouse emissions. There are various renewable sources of energy i.e solar, wind, hydel & biomass energy which has been reported by various researcher in recent and past (8, 9). The spinel type ferrites MFe_2O_4 have found their important applications such as those in microwave devices, humidity sensors, electronic industries, magnetic recording media, information storage systems & green anode materials (10- 12). Magnetic nanoscale materials can be used in a variety of medical and biological applications. Hyperthermia and medicine targeting are two potential fields in which nanostructured magnetic components, such as nanoparticles and mesoporous ferrite, are expected to play a vital role (13). Because of their targeting and delivery capabilities, magnetic NMs (nanomaterials) are attractive candidates for drug delivery to malignant tumours and local hyperthermia (14, 15).

Conclusions: Magnesium ferrite nanoparticles materials are prospective candidates for modern technological applications in the sectors of energy, environment, electronics, and biological applications due to their tunable structural, electrical, and magnetic properties. Magnesium ferrite has been used from many decades but still many research works are in progress in several fields.

Keywords: *Magnesium Ferrite; Nanomaterial; Energy; Biomedical Application; Environment; Electronics*

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