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Evolution of Nano composites as Smart Materials: A Systematic Review Study

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ABSTRACT

ABSTRACT: This review paper is about development and evolution of nanocomposites to smart materials. With the idea of formulating dental materials with long lasting maintenance and functionality, it is important to incorporate certain features such as polymer nanofibers, natural fibers, natural clay, nanoclays, metal oxides, carbon nano fillers, metallic particles and sulphides of different ions. Therefore, it helps nanocomposites to deal with both external as well as internal stimuli in order to maintain its structural and functional integrity.

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KEYWORDS: Polymer nanocomposites, nanofillers, physical stimuli, smart polymers, biotechnology

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INTRODUCTION

Polymer nanocomposites(PNC's) are infused by nanofillers which can be spherical, layered, fibrous and tubular.(1) In order to activate the nanocomposites to react with different kind of stimulus (chemical or physical), nanofillers are introduced.(2) It has been proved that smart or intelligent materials consists of stimulus responsive characteristics such as internal or chemical stimuli and external or physical stimuli.(3,4)

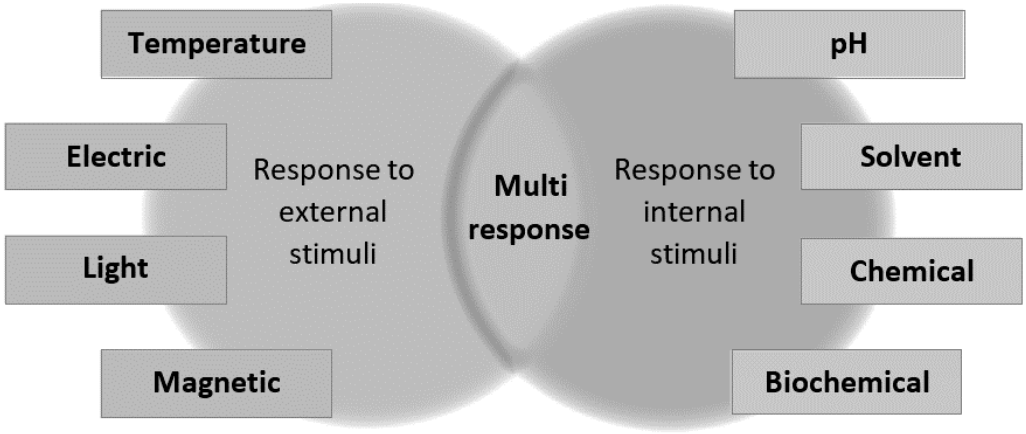
Chemical stimuli consist of pH, solvent, chemical, biological or enzymatic alterations whereas physical stimuli consist of temperature, electric current, light and magnetic field.(2) The composition of polymeric nanofiller composites consist of organic constituent (polymer nanofiber, natural fibers; cellulose, flax, wood and natural clay)(5,6) and inorganic contituent (nanoclays, metal oxides, carbon nanofillers, metallic particles, sulphides).(7-10)

Sufficient introduction of graphene oxide(GO) in the nanoparticles frmaework leads to enhancement of

photocatalytic efficiency.(11,12) Hence involvement of certain ions, particles proved to show some kind of evolution of new form of matrix structure.

REVIEW

This review article has considered opinions of different authors accordingly. Zhao et al explained about the importance of Fe_3O_4 and polylactic acid for 4D printing of a tracheal scaffold.(13)Zhara et al studied about regeneration process of osteoprogenitor cells which shows magneto-responsive compartment(based Fe_3O_4 and crosslinked alginate matrix loaded with bone morphogenetic protein-2) transformed to gel like structure used as cell culture platform (loaded with stromal cell-derived factor 1-α). Wan et al proposed that 4D material based on poly(D,L-lactide-co-trimethylene carbonate), where trimethylene carbonate which provides softness in the matrix, while CNT's was selected as nanofiller.(14)



Yang et al., explained about a polymer composed of 2-acrylamide-2-methyl propane sulfonic acid (AMPS) and acrylamide (AAm) and reduced graphene oxide (rGO) as filler, performed in-situ polymerisation of GO nanoplatelets, then GO were reduced by hydrazine to obtain rGO/poly(AMPS-co-AAm) nanocomposite with electric controllable swelling/deswelling behaviour.[15]Chu Chen et al performed experiment on Mg-doped GO composite for the storage of hydrogen molecules.[16]With the incoporation of metal or oxide nanoparticles, there is formation of localised surface plasmon resonances (LSPR) when particle surface interacts with a light source.[17]Li et al introduced the technique of using hydrogen sulfide based platform with the us of NIR light interaction with a combination of reduced graphene.[18]Raza et al explained about the mechanism of drug delivery for cancer treatment by the evaluation of NIR radiation to nanoparticles.[19]Cui et al introduced 4-D nanoprintable composite.[20]

CONCLUSION

With the evolution of technology, it is the basic requirement to modify composite restorative materials in certain ways in order to cope up with different oral environmental conditions such as temperature and electromagnetic field changes.

CONFLICTS OF INTEREST: The author declare no conflicts of interest.

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