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Research Article

PREPARATION AND CHARACTERIZATION OF NEW BIOPOLYMER NANOCOMPOSITES BASED ON EPOXIDIZED PALM OIL/ POLYBUTYLENE SUCCINATE MODIFIED CLAY

Manar Ghyath Abd-Almutalib Al-Mosawy*,

Department of Laboratory Equipment, Imam Jaffar AL-Sadeq University, AL-Najaf, Iraq.

Abstract

Polybutylene Succinate (PBS) is example of the biodegradable polymers have pulled in a great deal of consideration in mainstream researchers as of late because of a quick development of escalated enthusiasm for the worldwide condition for options in contrast to oil based polymeric materials. The modify clay is utilize in the production of the PBS/palm oil (EPO) mix nanocomposite. It was set up by fusing 0.5 - 5 % of chalcone - BNT and azo-BNT. The interaction of the modifier layer was described by X-ray Diffraction (XRD) and Fourier transform infrared (FTIR). When the mixture PBS/EPO is poured the solution is from modified clay which the nanocomposites are produced at the weight proportion of 80/20, which have more than others astounding lengthening at break. The XRD, Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) results affirmed the generation of nanocomposites. PBS/EPO nanocomposites show higher warm solidness and noteworthy improvement of examination with those of PBS/EPO combination. The modernity of this research is utilization of chalcone and azo which decreases the reliance on oil based surfactants.

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1. Introduction

A standout amongst encouraging contender for biodegradable engineered polymers is PBS (Oishi *et al*., 2006; Al-Mulla, 2011). Along the same lines, much effort has been made by researchers in materials and architects to find, create and change biodegradable polymers from sustainable assets (Reddy *et al*., 2012). Notwithstanding its applications in manufacturing of materials, PBS is a hopeful contender to deliver expendable bundling. Be that as it may, low sub-atomic weight and low firmness and surprising expense limit its enforcement (Sugihara *et al*., 2006; Yu *et al*., 2009; Cho *et al*., 2010). Numerous tests had be conducted to improve properties by utilize low-weight plasticizers (Dean *et al*., 2007; Al-Mulla *et al*., 2010; Al-Mulla, 2011; Shemmari and Rabah, 2014; Radhi and Al-Mulla, 2015). The plasticizers announced that physical, warm properties and bioactive decomposition of PBS were assessed by altering it with peroxide (Kim *et al*., 2001; Park and Im, 2002; Yokohara and Yamaguchi, 2008). It provides numerous favorable circumstances in

Corresponding author*: **Manar Ghyath Abd-Almutalib Al-Mosawy

E.mail: manarghyath@yahoo.com

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concoction businesses scope since it is gotten of sustainable, biodegradable and plenteous crude materials (Al-Mulla *et al*., 2010; Al-Mulla, 2011).

The nanocomposite is form by binding the organic clay in the polymer another way of changing the materials properties. When the weight of organic clay is increased by 0.5 – 5 %, improvements in thermal stability and mechanical and physical properties are observed in the empty organoclay polymer (Kulinski and Piorkowska, 2005; Ren *et al*., 2006). The adjustment of common clay (Bentonite) may do by means of trading the first interlayer a positively charged ion by natural positively charged ion where are they changed of organophobic to organophilic Material and fundamentally increment the Basal distance of clay layers (Giannelis, 1998). The length of the alkyl chain is known to depend on the degree of swelling and the ability to replace the cation in the clay (Zidelkheir and Abdelgoad, 2008). Through the exchange of cations in clay minerals more organic clay is obtained which includes sodium ions Na^+ hydrate with alkyl ammonium process and Characteristics of PBS/EPO MMT nanocomposite was researched and described utilizing X-ray diffraction, TEM (Giannelis *et al*., 1999; Arroyo *et al*., 2003).

PBS - based nanocomposite were prepared with EPO and MMT. It was reported that compounds based on organometallically modified Montmorelite have shown potential competition between polymer and plastic matrix for the intersection of aluminum layers (Paul *et al*., 2003). The research, two different ammonium compounds (chalcone) and Azo were utilized to modify Bentonite clay. The present check shown plasticizer PBS - based nanocomposites, epoxidized Palm oil (EPO) and montmorillonite adjusted *via* chalcone and azo. This is significant for some concoction ventures as they are gotten from sustainable, biodegradable, naturally inviting and effectively accessible crude materials.

2. Materials and Methods

Materials

Sodium Bentonite was obtained Sigma Aldrich, Germany. EPO and PBS was provision *via* AOTD, Malaysia. The $CHCl_3$ were purchased out of local provider from Nagoya, Japan and Merck, Germany, sequently. The HCl was from J.T. Baker, USA (Manar Ghyath *et al*., 2017).

Preparation of PBS/EPO–clay nanocomposites

The amount of PBS and EPO 50 ml of chlorophom is dissolved separately. EPO solution transfers PBS solution with drops and continuous stirring. Each EPO solution is then transferred to PBS solution and then mixed for 1 hour. For the modified clay (chalcone-BNT and azo-BNT) in PBS/EPO, the mixture is returned to the condenser for one hour. The mixture is then completely mixed in PBS/EPO solution. The nanocomposite is casting into the petri dishes to dry up. The amount of PBS/EPO and organo clay is utilized in the research and list in the Table - 1.

Sample	Weight of PBS (g)	Weight of EPO(g)	Weight of organoclay(g)
1	0.9	0.1	0.00
2	0.86	0.09	0.05
3	0.82	0.08	0.1
4	0.78	0.07	0.15
5	0.74	0.06	0.02
6	0.5	0.25	0.25

Characterization

Tensile properties

The tensile strength by using an Instron Universal Testing Machine 4301 at 5 mm min^{-1} of crosshead speed, in accordance with ASTMD 638.32

X-ray diffraction (XRD) analysis

An X-ray diffraction study (XRD) was performed using a Shimadzu XRD 6000 diffraction scale with Cu K α radiation (0.15406 nm). The survey drawing in the diffraction ranges from 2◦ to 10◦ at a rate survey of 1◦/min.

Thermogravimetric analysis (TGA)

The thermal stability of the samples was studied by utilizing the thermal TGA measurement analyzer of Perkin Elmer. Sample was heated from 35 °C to 500 °C with a heating average of 10 °C/min in nitrogen atmosphere at a nitrogen flow average of 20 ml/min.

Scanning Electron Microscopy (SEM)

SEM was recorded by Scanning Electron Microscopy, Angstrom (model AIS-2300C) USA.

Transmission Electron Microscopy (TEM)

Clay dispersion was studied utilize an electron microscope for transmit of energy filtration (EFTEM). TEM images were taken into the electron microscope of the alEO912AB Energy Filtering Transmission with an acceleration voltage of 120 kV. The samples were prepared using the tricotum (Reichert and Jung). Thin sections of about 100nm were cut with a diamond knife at 120 °C).

3. Results and Discussion

Mechanical properties

The PBS/EPO weight ratio was determined at 80:20 according to the firstly realization which accord the highest tensile strength of the blend. Subsequently, the percentage was selected in subsequent trials. The Figure - 1 illustrates the influence of clay content on the tensile strength property of PBS or EPO or chalocone nanoocomposite or OBNT and PBS or EPO or azo-OBNT. The top tensile strength was get when clay content was 2 % of weight. Increased clay contents increases the tensile strength. Na-BNT makes as traditional molecular fillers in the PBS/EPO matrix. The tensile strength of the PBS / EPO mixture drops to 9.87 MPa. Adding 0.5, 1 or 2 php of OMTT in PBS/EPO combination increment the tensile strength. The higher tensile strength (22.63 MPa) was observed with 2 basis points of the ALC-OBNT and the tensile strength was observers 21.09 with 2 basis points of AZO - OBNT.

XRD analysis

Monolayer arranging of chalcone and azo are created in the interlayer space of Na-BNT. The XRD type of the nanocomposites arranged utilizing two distinctive chalcone and azo (alkyl ammonium gatherings) adjusted bentonite nanocomposites (Figure - 2) (Manar Ghyath *et al*., 2017). In the nanocomposites where the bentonite surface is pretreated and, the basal separating of the dirt expanded to nanometers, individually. Be that as it may, when the bentonite surface is pretreated with chalcone and azo the basal separating further increments to 3.84 (Table - 2). The size of the surface increases with the increase of the base spacing of the organic layer in the polymer matrix as see (Agag and Takeichi, 2000). These XRD designs likewise recommend that all the nanocomposites created are intercalated mixes and some peeled.

TGA analyses

Thermal gravity analyzes were conducted on PBS/EPO/chalcone - BNT nanocomposite to determination the influence of modified clay content in the polymer matrix on thermal property. TGA results appear in Figure - 3. The first of degeneration of highest nanocomposite, i.e., 265 and 288 °C for PBS/EPO including azo-BNT and chalcone-BNT sequentially, in comparison with PBS/EPO mix (245 °C).The consequenc offer that thermal stability increases with the added of chalcone - BNT and azo - BNT.

SEM

The accumulated clay was imaged by electron microscopy. In the light of the differences between the diffusion density between the clay and PBS, EPO/azo-BN and PBS, the massive EPO/ chalcone-BNT T aggregates can be photographed without much stretch with SEM. The SEM images of the broken surface of nanoparticles are shown in Figure - 4. These images did not exhibit inorganic distances the most imaginable amplification, which means that the nanotubes are well transferred in PBS and EPO/Na-BNT. The cluster was separated into a submicron size that cannot be seen at this amplification.

TEM

TEM micrographs of the enhanced the PBS/EPO demonstrates that it can be seen that the original Na-BNT stack formation has been fully conserved with PBS/EPO because of the non-compliant nature of each of the components (Figure - 5). Dark lines appear the thicknesses of divided into clay coat and aggregates. Organic clay does not appear the structure of the original layers. The associated platelet structure, consisting of a variable number of plates and their totality can be indicated. TEM image showing higher degree of peeling and some peeling areas for PBS/ EPO/ chalcone-BBNT and PBS/ EPO/ azo-BNT.

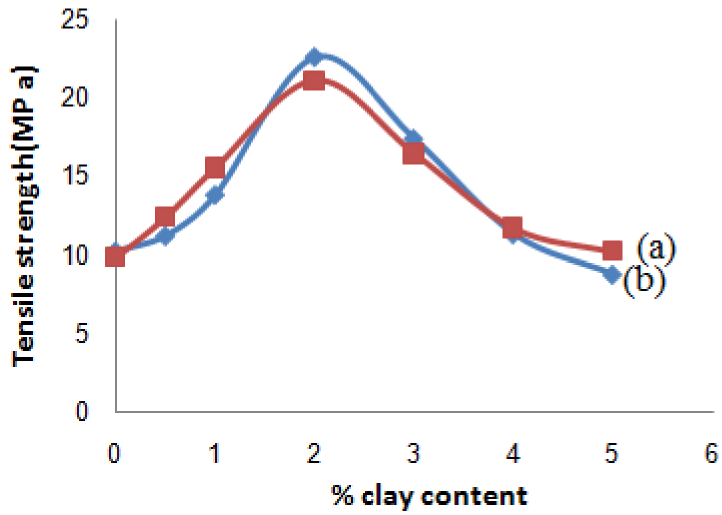


Figure – 1: Tensile properties of (a) PBS/ EPO/ Chalcone - OBNT and (b) PBS/ EPO/ azo -OBNT nanocomposite

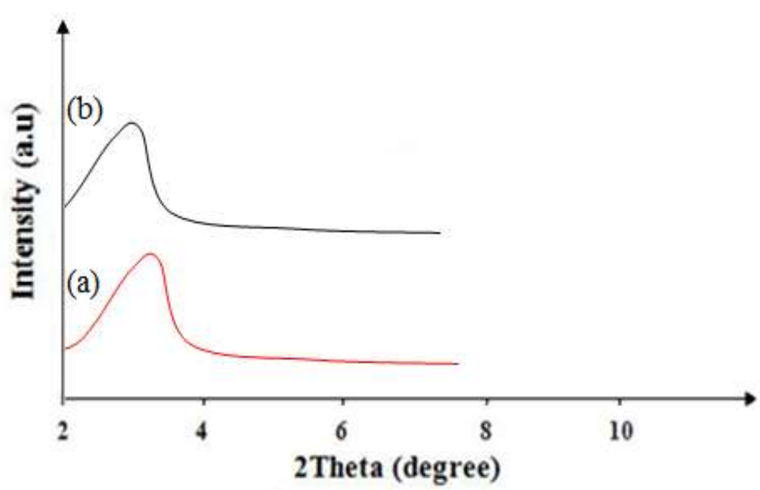


Figure – 2: XRD patterns of PBS/ESO/ chalcone and azo modified clay nanocomposites

Table – 2: Diffraction angle and basal spacing of PBS/EPO/chalcone, azo modified clay nanocomposites

Sample	2Θ (°)	d-Spacing(nm)
80PBS20ESO/chalcone –BNT	3.3	3.84
80PBS20ESO/azo-BNT	3.5	2.47

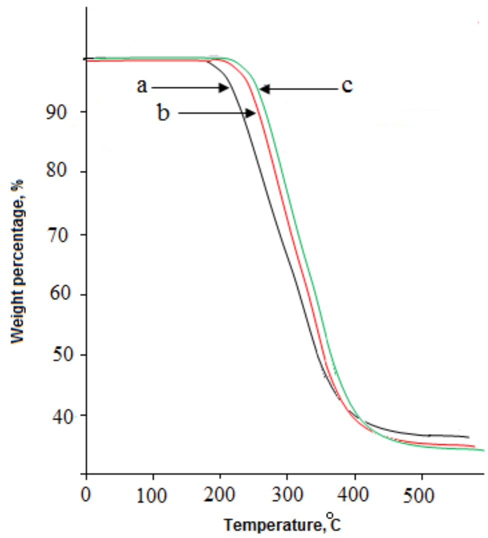
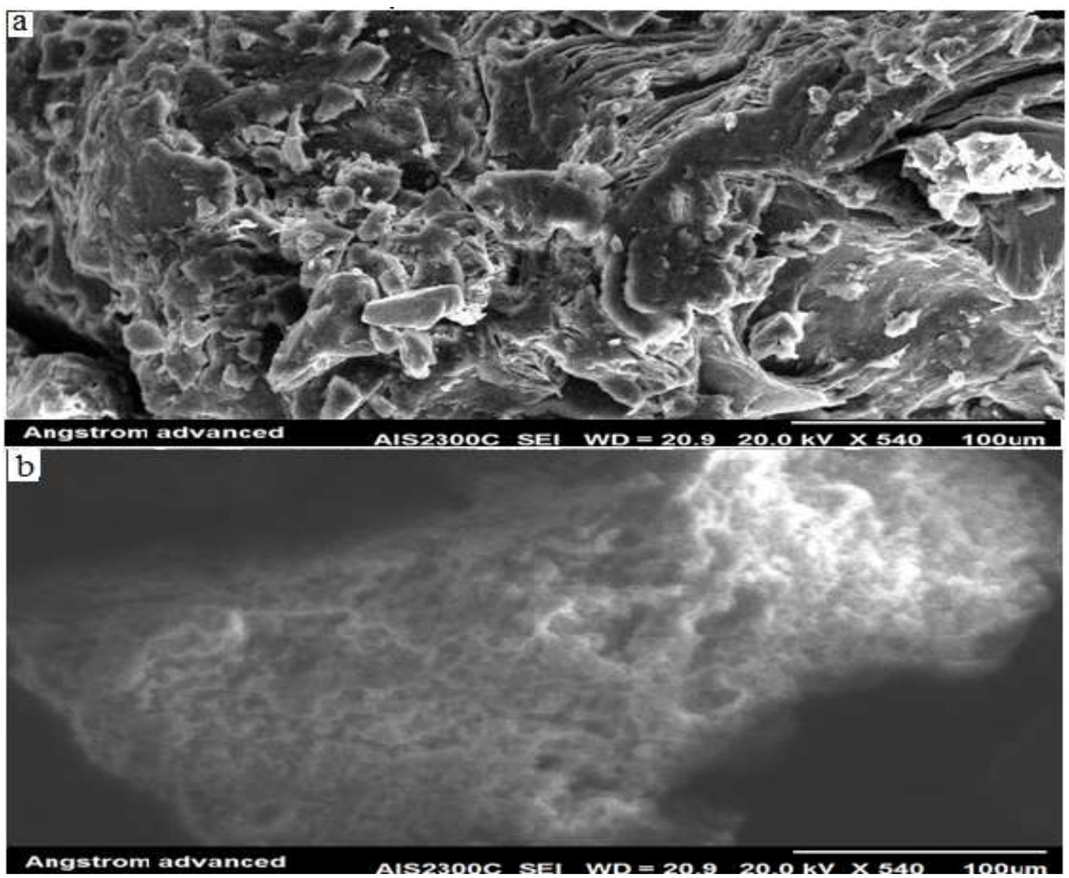


Figure – 3: **TGA (a) PBS/EPO blends, (b) PBS/EPO/ azo-BNT and (c) PBS/EPO/ chalcone - BNT**



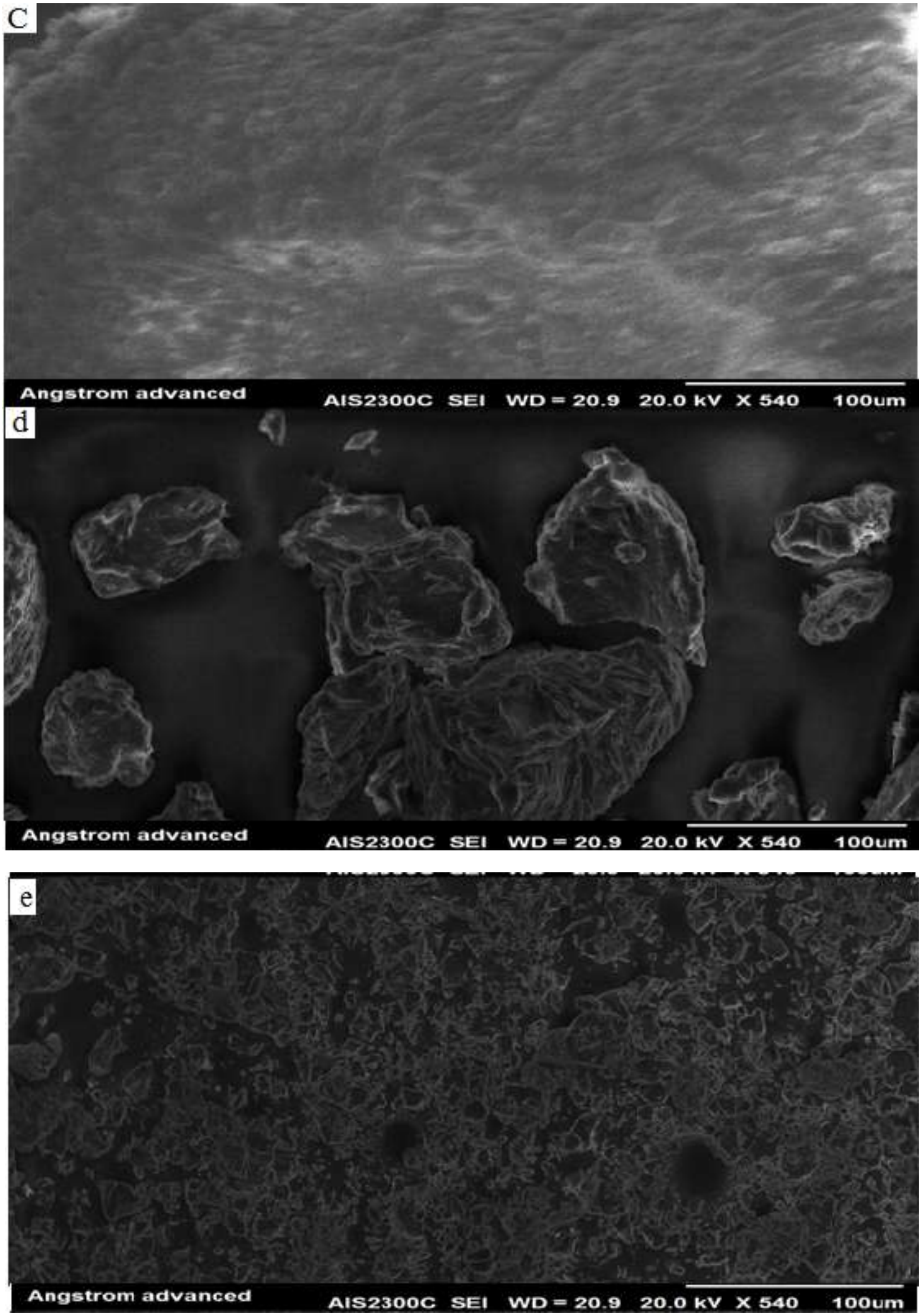


Figure – 4: Scanning Electron Microscope micrographs of fracture surfaces of (A) Na-BNT (B) neat PBS, (C) PBS/EPO blends, (D) PBS/EPO/chalcone -BNT and (E) PBS/EPO/azo-BNT

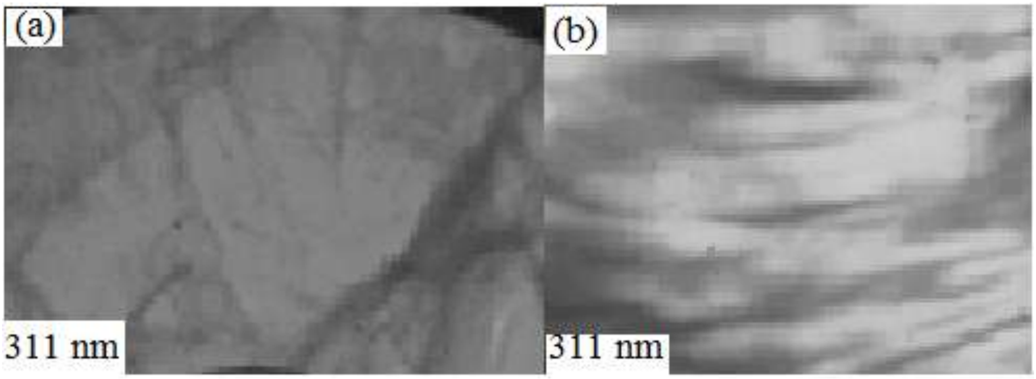


Figure – 5: TEM (A) PBS/EPO/chalcone -BNT and (B) PBS/EPO/azo -BNT

4. Conclusion

The research, new polymeric nanocomposite are preparation by treating BNT modified PBS modified with BNT with alkalo and azo. PBS/EPO - micro-compounds were prepared by incorporating 2 % of chalcone - BNT and azo - BNT. The TEM analyzes appear that the preparation nanocomposites are derived with partially peeled species (chalcone-BNT and azo-BNT). These nanocomposites a good filters for the production of disposable packs due to thermal characteristics, reprocess ability are produced of renewable, biodegradable, environmentally associated and readily rotten mineral. The active surfaces (chalcone) and Azo utilized in this clay modification studied would reduce dependent on oil-base surface materials.

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