Yet another objective of the present invention is to decolorize the dark brown coloured BFP for making better optically transparent composite film.

SUMMARY OF THE DISCLOSURE

In the present disclosure, composite films containing bio-derived furanic polymer (at various wt. % ratios with respect to other polymer) and another polymer of natural or synthetic origin (several polymers including organophilic polymers) are prepared. The films were characterized for various physiochemical measurements to assess their durability and stability. The UV-shielding efficiency of these composite films was assessed by varying different process parameters. The durability of the films for this said property was also evaluated by treating these films under direct UV-irradiation for an extended time or sunlight exposure for several weeks to months. In addition, the UV-shielding efficiency of the composite films obtained in this disclosure was compared with other conventionally used UV-absorbers such as bio-derived materials and inorganic oxide materials.

In order to overcome the solubility of these bio-derived furanic polymers, various solvents were tested and the desired solubility was achieved by using solvents such as DMSO, DMF NMP or alkaline medium. Having known the structural changes associated upon alkaline dissolution and environmental unfriendliness associated with DMF, DMSO and NMP were chosen a solvent for casting the films.

In one aspect, provided herein is a UV shielding composite thin film having a thickness in the range of 0.06 to 0.08 mm comprising: i) 0.5 to 2.0 wt% of biomass saccharide derived furanic polymer (BFP); and ii) 99.5 to 98.0% of synthetic or natural polymer.

In an example of the present disclosure provides, UV shielding composite thin films having thickness in the range of but not limited to 0.06 to 0.08 mm comprising bio-derived furanic polymer (BFP) and synthetic or natural polymer with high thermal stability, mechanical stability, optical transparency and elasticity. Wherein BFP is obtained by a process via catalytic dehydration of biomass saccharide as substrate at various concentrations in the range 5-70% with respect to the solvent in solvents, not limited to, DMSO, or ionic liquid (BMImCl) and separated from the reaction mixture by a precipitation method using a precipitation solvent but not limited to water or MeOH, washed with water, MeOH or both and dried, but not limited to, in ambient condition at room temperature in the temperature range 24-28 ˚C, in vacuum at 25 ˚C to 70 ˚C, or in an air oven at temperature in the range of 80 to 105 ˚C.

radiation for 90 min, sunlight for 30 days and treatment temperature in the range -20 to 210 ˚C.

In another aspect, provided herein is a process for preparing UV shielding composite thin film as disclosed herein, comprising the following steps:

i. obtaining BFP by a process of catalytic dehydration of biomass saccharide in DMSO, or 1-butyl,3-methylimidazolium chloride; separating the BFP from the reaction mixture by precipitation using a precipitation solvent selected from the group consisting of, water and MeOH; washing the precipitated BFP with water, MeOH or both; and drying BFP using ambient condition at temperature in the range of 24-28°C, or vacuum at 25°C to 70°C, or temperature in the range of 80 to 105°C wherein the catalyst is selected from the group consisting of $AlCl_3$, $CrCl_3$, $CuCl_2$ + alumina, ion-exchange resins and HCl;

ii. dissolving a synthetic or natural polymer and BFP prepared in step i) in a solvent at a temperature in the range of 60 to 120°C under stirring in the range of 350-450 rpm to form a homogenous solution;

iii. drying the homogenous solution obtained in step ii) at a temperature in the range of 60 to 120°C for 2 to 4 days to obtain a film; and

iv. cooling the film to a temperature in the range of 24-28°C, and peeling out the composite film.

The present disclosure provides a process for preparing UV shielding composite thin film having high thermal stability, mechanical stability, optical transparency, elasticity and thickness in the range of 0.06 to 0.08 mm as claimed in claim 1 comprising the following steps:

i. obtaining BFP by a process of catalytic dehydration of biomass saccharide in DMSO, or ionic liquid (1-butyl,3-methylimidazolium chloride); separating the BFP from the reaction mixture by precipitation using a precipitation solvent selected from the group consisting of, water and MeOH; washing the precipitated BFP with water, MeOH or both; and drying using ambient condition at temperature in the range of 24-28˚C, or vacuum at 25˚C to 70˚C, or at temperature in the range of 80 to 105˚C.

ii. dissolving a synthetic or natural polymer and BFP prepared in step i) in a solvent at a temperature in the range of 60 to 120˚C under stirring in the range of 350-450 rpm to form a homogenous solution;

iii. drying the homogenous solution obtained in step ii) at a temperature in the range of 60 to 120˚C for 2 to 4 days to obtain a film; and

We claim:

1. A UV shielding composite thin film having a thickness in the range of 0.06 to 0.08 mm comprising: i) 0.5 to 2.0 wt% of biomass saccharide derived furanic polymer (BFP); and ii) 99.5 to 98.0% of synthetic or natural polymer.

2. The UV shielding composite thin film as claimed in claim 1, wherein the biomass saccharide is selected from the group consisting of, agarose chitosan, κ-carrageenan, cellulose, seaweed cellulose (Ulva), potassium alginate, starch, glucose, fructose, sucrose and xylose.

3. The UV shielding composite thin film as claimed in claim 1, wherein the synthetic polymer is selected from the group consisting of polyvinyl alcohol, polyvinyl chloride, polyvinylidene fluoride and polymethyl methacrylate.

4. The UV shielding composite thin film as claimed in claim 1, wherein the natural polymer is selected from the group consisting of agar, agarose, carboxymethylcellulose, hydroxypropylmethylcellulose, κ-carrageenan and potassium alginate.

5. The UV shielding composite thin film as claimed in claim 1, wherein the UV-shielding efficiency is retained even on exposure to UV-radiation for 90 min, or in sunlight for 30 days and can be altered upon thermal treatment in the range -20 to 210°C by 32.5% of wavelength range.

6. A process for preparing UV shielding composite thin film as claimed in claim 1 comprising the following steps:

   i. obtaining BFP by a process of catalytic dehydration of biomass saccharide in DMSO, or 1-butyl,3-methylimidazolium chloride; separating the BFP from the reaction mixture by precipitation using a precipitation solvent selected from the group consisting of, water and MeOH; washing the precipitated BFP with water, MeOH or both; and drying BFP using ambient condition at temperature in the range of 24-28 °C, or vacuum at 25 °C to 70 °C, or temperature in the range of 80 to 105 °C wherein the catalyst is selected from the group consisting of $AlCl_3$, $CrCl_3$, $CuCl_2$ + alumina, ion-exchange resins and HCl;

   ii. dissolving a synthetic or natural polymer and BFP prepared in step i) in a solvent at a temperature in the range of 60 to 120°C under stirring in the range of 350-450 rpm to form a homogenous solution;

iii. drying the homogenous solution obtained in step ii) at a temperature in the range of 60 to 120˚C for 2 to 4 days to obtain a film; and

iv. cooling the film to a temperature in the range of 24-28ºC, and peeling out the composite film.

7. The process as claimed in claim 6, wherein the solvent used in step ii) is selected from the group consisting of dimethyl sulfoxide, n-methyl-2-pyrrolidone, dimethyl formamide and tetrahydrofuran.

8. The process as claimed in claim 6, further comprising modifying the colour of the film by decolorized BFP by treating with hydrogen peroxide, or by UV irradiation in THF (tetrahydrofuran).