# SYNTHESIS AND CHARACTERIZATION OFLACTIC ACIDGRAFTEDTiO$_2$ NANOCOMPOSITES

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# SYNTHESIS AND CHARACTERIZATION OFLACTIC ACIDGRAFTED $TiO_2$ NANOCOMPOSITES

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QASAR SALEEM

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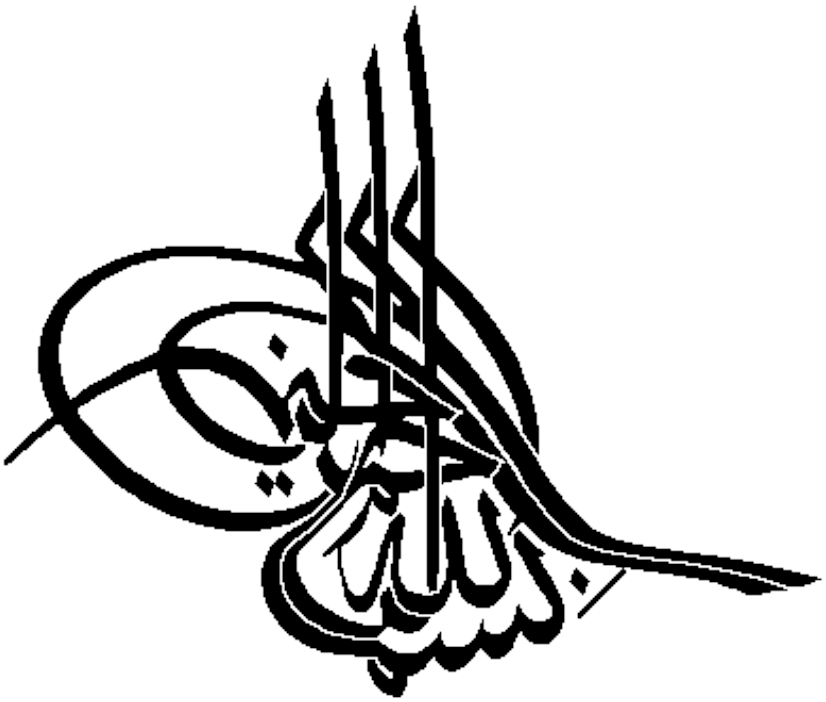

*In the name of*

# *Allah,*

*The most Compassionate,*

*The most merciful*

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# DECLARATION

I **Qasar Saleem** S/O**Muhammad Hussain** ID: 13001140006

Session **2013-2015** hereby declare that the matter printed in the thesis titled **"SYNTHESIS AND CHARACTERIZATION OF LACTIC ACID $TiO_2$ NANOCOMPOSITES"** is my own work and has not been printed, published and submitted as research work, thesis or publication in any form in any University, Research institution etc. in Pakistan or Abroad.

*Dated:* _____ *QASAR SALEEM*

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## RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis titled, *"SYNTHESIS AND CHARACTERIZATION OF LACTIC ACID GRAFTED $TiO_2$ NANOCOMPOSITES*" has been carried out and completed by **Qasar Saleem, ID: 13001140006**. The quantum and the quality of the work contained in this thesis are adequate for the award of Degree of MS/M. Phil.

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# Dedication

Affectionately Dedicated to My Late mother, my wife and my sweet sons (Rabeel and Ramish), due to whom Prayers and Cooperation I am able to reach this destiny.

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# ABSTRACT

The aim of my project is to synthesize and analyze Polylactic acid-grafted $TiO_2$ nanocomposite. When dispersed at the nanoscale $TiO_2$ can behave as see through transparent UV filters and thermomechanical materials. The synthesis plan involved three stages. First, dispersion of $TiO_2$ white powder in water/ethanol solvent system. Second grafting $TiO_2$ surface by oligomers of lactic acid aimed at changing its surface features. Third polymerization of lactic acid monomer with grafted $TiO_2$ in the presence of anhydrous stannous chloride as catalyst. Polylactic acid grafted-$TiO_2$ nanocomposite was synthesized by melt poly condensation *in situ* of lactic acid onto titanium oxide ($TiO_2$) nanoparticles surface. The product was characterized by TGA, DSC, FTIR, and UV analysis and degradation observation. An idea regarding bonds between the

grafting polymer and surface modified titanium oxide nanoparticlals. Characteristics peaks of Ti–carbonyl bond, the related intensities of the Fourier transmission absorption peaks of graft composite, the melt and decomposition behavior stages of Polylactic acid-grafted $TiO_2$ nanocomposite convinced that oligomers of polylactic acid were chemically bonded on the surface of $TiO_2$ nanoparticles. Through grafting Polylactic acid, the Polylactic acid grafted - $TiO_2$ sample shown good absorption in UV region and degradation behavior under normal atmospheric conditions. Regaining transparency of degraded white opaque Polylactic acid-grafted $TiO_2$ nanocomposite on heating was another character. Polylactic acid-grafted $TiO_2$ nanocomposite will be a potential candidate in future for biomedical, UV shielding and environment friendly material.

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