DECLARATION

I, **Ms. Mahima Misti Sarkar**, hereby declare that the work presented in my thesis entitled "***Evaluation of silica nanoparticles and their functionalization in the alleviation of salinity stress in two legumes – Lens culinaris and Glycine max***" has been carried out by me under the supervision of **Dr. Swarnendu Roy**, Assistant Professor, Department of Botany, University of North Bengal for the award of the degree of **Doctor of Philosophy (Ph.D.) in Science (Botany)**. I also declare that this thesis or any part of this has not been submitted for any other degree/diploma either to this or other Universities.

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It is certified that the work presented in the thesis entitled "***Evaluation of silica nanoparticles and their functionalization in the alleviation of salinity stress in two legumes – Lens culinaris and Glycine max***" by **Ms. Mahima Misti Sarkar**, has been carried out under my supervision. I am forwarding her thesis for the Ph.D. degree in Science (Botany) at the University of North Bengal. She has fulfilled all the requirements according to the rules of the University of North Bengal regarding the works existing in her thesis. This thesis or any part of this has not been submitted for any degree or diploma either to this or other Universities.

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DRC CERTIFICATE

It is certified that the work contained in the thesis titled **"Evaluation of silica nanoparticles and their functionalization in the alleviation of salinity stress in two legumes – *Lens culinaris* and *Glycine max*"** by **"Ms. Mahima Misti Sarkar"** has been carried out following University guideline and it has been approved by the members present in the meeting of the Departmental Research Committee in Botany for processing by the Board of Research Studies.

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Mahima Misti Sarkar

PREFACE

In the rapidly expanding world population, the necessity of "Sustainable Food Security" has been a serious matter of concern. The accelerated environmental pollution and global warming have brought forth various destructive forces engulfing global food production. Among those disparaging forces, salinity has emerged as one of the crucial abiotic stresses that impede substantial damage to the production of food crops. Salinity affects the overall plant health, resulting in poor growth and development of plants along with loss in plant productivity and nutritional components. Mother Earth was initially nurtured with excessive amounts of fertilizers and minerals to confront these challenges. Instead of curing the complications, the over-application of these chemical fertilizers has worsened the situation, resulting in the loss of soil fertility. Therefore, a consequential demand for alternative sustainable strategy is a matter of high priority.

Nanotechnology has emerged as a viable solution in the past decade to address this crisis. Nanomaterials having a high surface area to volume ratio, are easily uptaken by plants playing a more interactive role with the cellular active components, and thus, their efficiency also gets amplified. Silica is a semi-essential element; its deficiency can retard the essential plant responses. In this connection, silica nanoparticles (SiNPs) possess great crop improvement potential because they can translocate more silica to plants. Applying SiNPs has been manifested to improve plants' tolerance to salinity. Moreover, the surface functionalization of these nanomaterials increases their efficiency and reduces the toxic effects at higher concentrations. Hence, this thesis explores the synthesis of SiNPs and sugar-functionalized SiNPs and their implementation against the NaCl-induced salinity stress in lentil and soybean plants.

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