Prof. Dr. M. Iqbal Choudhary *Mustafa (PBUH) Prize Laureate, H.I., S.I., T.I.*
Coordinator General

Khwarizmi Laureate/ Distinguished National Professor
Ph.D. (University of Karachi)
Sc.D. (University of Karachi/ Al-Farabi Kazakh National University)
Senior Fulbright Fellow (Scripps Institute of Oceanography, UCSD, USA)
Postdoctoral Fellow (Cornell University/ Penn. State University, USA)
Fellow The World Academy of Sciences/ The Islamic World Academy of Sciences/ Pakistan Academy of Sciences

Dated: 15th July, 2025

Foreign Supervisor's review of the thesis entitled: "Hydrogel forms of hydroxypropylmethylcellulose and bentonite clay based on plant extract *Tamarix Hispida*" for the Degree of Doctor of Philosophy (Ph. D.) in specialty 8D05301-Chemistry.

Ms. Amanzholkyzy Arailym, a Ph.D. student of Al-Farabi Kazakh National University, Almaty, Kazakhstan has successfully completed a part of her Ph. D. research as a collaborative student under my supervision at the Hussain Ebrahim Jamal (H.E.J.) Research Institute of Chemistry, International Center for Chemical and Biological Sciences (ICCBS), University of Karachi-75270, Pakistan, from 3rd September 2022 to 23rd January 2023.

During this period, Ms. Amanzholkyzy Arailym worked on a research project entitled "Hydrogel forms ofhydroxypropylmethylcellulose and bentonite clay based on plant extract *Tamarix Hispida*". Ms. Arailym proved herself as a qualified and dedicated Ph. D. student during her post-graduate internship.

The main objective of her study was to determine the chemical composition of water-ethanolic extract obtained by ultrasound extraction of the *Tamarix Hispida* from *Tamaricaceae* family that grows on the territory of Kazakhstan and evaluation of their biological activities. The new hydrogel forms from HPMC (hydroxypropylmethylcellulose) and Bentonite clay obtained with and without extract and determination of their physical-chemical properties.

Ms. Amanzholkyzy A. worked on HPLC, LC-MS, SEM, performed extraction, column chromatography, Vacuum Liquid Chromatography (VLC), Thin-Layer Chromatography (TLC), animal studies, *in-vivo* studies on rats, and etc. during her Ph. D. research work. As a result, she gained expertise in the column chromatography, compound isolation, identification of chemical composition and evaluation of biological activities.

During her internship, she collected dissertation-related materials from the ICCBS Research Library. A hydrogel with biologically active extract was obtained and its properties were studied by SEM, AFM microscopy. The key findings of this dissertation's research work were published in international and local journals and conference proceedings.

In general, Ms. Amanzholkyzy A. can be described as a responsible and competent research scholar. I am confident that the experience she has gained during her internship in my laboratory will assist her further to make career in the field of science and technology. She was found to be very cooperative with other research fellows.
In addition to the above, her Ph. D. dissertation is well written and organized, and the provided methods and approaches are sufficient to produce some valid conclusions. Thus, the thesis has great theoretical and practical significance having a good scientific work that meets the requirements of the Ph. D. dissertations, and therefore, the author Ms. Amanzholkyzy Arailym deserves to be awarded the degree of Doctor of Philosophy Ph. D. on specialty 8D05301–Chemistry.

Prof. Dr. M. Iqbal Choudhary
Foreign Scientific Supervisor