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Scientific Consultant's Review

of the dissertation by Anel Satzhankyzy Keleke, entitled "Pharmacognostic study of *Hedysarum semenowii* Regel & Herder as a source of biologically active substances",
submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D10102 – "Pharmacy"

The study "Pharmacognostic study of *Hedysarum semenowii* Regel & Herder as a source of biologically active substances" is highly relevant as it aligns with Kazakhstan's strategic initiative to develop the domestic pharmaceutical industry and utilize local medicinal plant resources. Despite the known therapeutic potential of the *Hedysarum* genus, including immunostimulating and antioxidant properties, *Hedysarum semenowii* has remained insufficiently studied from a pharmacognostic perspective. This work fills a significant gap in scientific knowledge about *H. semenowii* species by evaluating it as a new potential source of biologically active substances for modern pharmacy.

The doctoral candidate relies on a robust methodological foundation, including standard pharmacognostic methods and international protocols. The findings obtained by Ms. Keleke are scientifically grounded and characterized by a high degree of reliability. The work provides a comprehensive data on morpho-anatomical features and phytochemical analysis of *Hedysarum semenowii*, as well as initial information on its biological activity. The dissertation demonstrates a clear, logical structure. There is a consistent conceptual thread linking the phytochemical study of the plant to its practical safety evaluation, which ensures the integrity of the research.

Ms. Keleke made a substantial personal contribution at all stages of the research. She independently performed the collection and primary GACP-compliant processing of plant material in the Almaty region. The candidate personally conducted the extraction processes and led the non-clinical experimental studies. Throughout the PhD program, Anel Keleke has demonstrated the qualities of an independent and meticulous researcher.

The dissertation by Anel Satzhankyzy Keleke meets all requirements for a PhD thesis in the specialty 8D10102 – "Pharmacy." Given the scientific novelty, practical significance, and high quality of the performed research, I fully support the candidate and recommend the award of the PhD in the specialty 8D10102 – "Pharmacy."

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