PHARMACEUTICAL PROSPECTS FOR DEVELOPING WATER-SOLUBLE GRANULES BASED ON *ROSA CANINA* L. AND *ZIZIPHUS JUJUBA* MILL. FRUITS

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Abstract. The development of water-soluble pharmaceutical granules based on medicinal plant materials represents a promising direction in modern pharmaceutical technology. This study concept focuses on the formulation potential of Rosa canina L. (rosehip) and Ziziphus jujuba Mill. (jujube) fruits as complementary sources of biologically active compounds. Rosehip fruits are known for their ascorbic acid, phenolic compounds, carotenoids, and other phytochemicals, whereas jujube fruits contain sugars, polyphenols, polysaccharides, and additional constituents that may contribute to their nutritional and functional properties. Combining these plant materials in a granulated dosage form may provide a practical approach to improving product handling, dose uniformity, and preparation convenience. The principal objective is to identify the technological and physicochemical factors governing the development of stable, rapidly dispersible granules. Particular attention is given to the selection of extraction conditions, excipients, granulation methods, drying parameters, moisture content, and preservation of heat-sensitive constituents. The proposed formulation strategy provides a basis for further experimental investigation and the development of standardized plant-based pharmaceutical products.

Keywords: Rosa canina L., Ziziphus jujuba Mill., medicinal plant materials, water-soluble granules, pharmaceutical technology, phytochemical composition, formulation development, quality control.

Introduction

Medicinal plants remain important sources of biologically active substances used in pharmaceutical research and the development of plant-based preparations. However, the incorporation of botanical raw materials into pharmaceutical dosage forms requires careful consideration of their chemical composition, stability, solubility, and technological characteristics. Although traditional herbal preparations are widely used, their conversion into standardized solid dosage forms presents opportunities for improving convenience, reproducibility, and quality control.

Rosa canina L. is a medicinal plant whose fruits contain ascorbic acid, phenolic compounds, flavonoids, and carotenoids. The concentration of these constituents depends on geographical origin, maturity, harvesting conditions, storage, and processing methods. Ziziphus jujuba Mill. fruits are characterized by the presence of carbohydrates, polyphenols, polysaccharides, and other phytochemicals. Their composition makes them relevant candidates for investigating multifunctional plant-based formulations. The combined use of these fruits may be of interest from both phytochemical and pharmaceutical perspectives. Nevertheless, the feasibility of combining them in a single formulation cannot be established solely from their individual properties. Compatibility, extract composition, moisture sensitivity, granule structure, and dissolution behavior must be investigated experimentally. Therefore, the development of water-soluble granules based on these botanical materials requires an

integrated approach that considers raw-material standardization, formulation design, and quality assessment.

Aim of the Study

The aim of this study is to substantiate the pharmaceutical prospects of developing water-soluble granules based on Rosa canina L. and Ziziphus jujuba Mill. fruits and to identify the principal formulation and technological parameters required to obtain a stable, reproducible, and readily dispersible dosage form.

Materials and Methods

The proposed research framework includes authenticated fruits of Rosa canina L. and Ziziphus jujuba Mill., selected pharmaceutical excipients, and suitable aqueous extraction systems. Botanical raw materials should undergo preliminary assessment for identity, purity, moisture content, and compliance with applicable quality requirements. Extraction procedures should be selected according to the target constituents, with particular attention to limiting the degradation of heat-sensitive compounds in rosehip material. The formulation stage should compare suitable granulation approaches, including wet granulation and alternative low-moisture or dry-processing techniques where technically appropriate. Excipients should be selected according to their effects on granule formation, wettability, dispersibility, mechanical strength, and storage stability. The proportions of the two botanical components and the type and concentration of excipients should be optimized through a systematic experimental design rather than selected arbitrarily. The proposed quality evaluation should include particle-size distribution, flowability, bulk and tapped density, moisture content, granule strength, dispersion time, and the presence of visible sediment or agglomerates

after reconstitution. Phytochemical characterization should assess selected marker compounds, including ascorbic acid and relevant phenolic constituents, using validated analytical procedures. Stability studies should investigate the influence of packaging, temperature, humidity, and storage duration on physical properties and marker-compound retention. Appropriate controls and replicate measurements should be incorporated to support reliable comparisons between formulations.

Scientific Discussion and Pharmaceutical Significance

The principal pharmaceutical challenge is to transform two chemically complex botanical materials into a dosage form with reproducible characteristics. Their combination may offer complementary formulation opportunities, but it also introduces technological challenges. Naturally occurring sugars and polysaccharides in jujube fruits may influence granule binding, hygroscopicity, and reconstitution behavior. Meanwhile, the stability of ascorbic acid and certain other constituents in rosehip material may be affected by heat, oxygen, light, and moisture. These factors should guide the selection of processing conditions and protective packaging. Water-soluble granules may offer practical advantages over conventional powdered herbal preparations, including reduced dust formation, convenient portioning, and potentially improved handling. Nevertheless, rapid dispersion does not necessarily establish complete molecular solubility. The final product should therefore be evaluated according to its intended pharmaceutical characteristics, distinguishing between true dissolution and the formation of a uniform aqueous dispersion. An important direction for formulation optimization is the simultaneous evaluation of technological performance and phytochemical preservation. A formulation with excellent flowability and rapid dispersion would not be satisfactory if processing caused substantial degradation of its marker compounds. Conversely, maximizing phytochemical

retention without achieving acceptable granule strength or reproducibility would limit its practical utility. A balanced optimization strategy should therefore consider both pharmaceutical quality attributes and chemical stability.

Furthermore, botanical variability must be addressed through raw-material authentication, standardized extraction, and the selection of appropriate analytical markers. The proposed product should not be assigned therapeutic efficacy, bioavailability, or clinical benefits solely on the basis of the known composition of its individual plant ingredients. Such claims would require additional experimental, toxicological, and, where appropriate, clinical evidence.

Conclusion

The development of water-soluble granules based on Rosa canina L. and Ziziphus jujuba Mill. fruits represents a promising research direction in pharmaceutical technology. The combination of these botanical materials may support the development of a convenient plant-based dosage form, provided that their physicochemical compatibility and formulation performance are established experimentally. The most important development priorities include the standardization of raw materials, optimization of extraction and granulation conditions, preservation of heat-sensitive constituents, and systematic assessment of dispersion and storage stability. Particular attention should be paid to the effects of moisture and naturally occurring carbohydrates on the technological properties of the granules. Future experimental studies should compare alternative formulations and identify the relationship between excipient composition, manufacturing conditions, and critical quality attributes. Ultimately, a scientifically validated formulation and an appropriate quality-control strategy will be

essential for determining the feasibility of translating this concept into a standardized pharmaceutical product.

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