

Novel Pharmaceutical Technologies in Collaboration with Pharmacognosy: A New Approach to Natural Product Research and Development

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Historical study of pharmacognosy indicates its evolution from a descriptive science which majorly dealt with botanical aspects of natural crude drugs, to a science embracing the chemistry and pharmacology of natural crude materials as well as pure active principles thereof. Early pharmacognosy was chiefly concerned with the description and identification of crude medicinal materials originated from plants or other natural sources. By development of phytochemistry, a strong association has emerged between these two sciences which can be considered as a landmark causing a redefinition of pharmacognosy [1]. During the last two centuries, there has been a worldwide trend towards the isolation and characterization of active compounds from plants in order to discovering and developing new drugs. An impressive number of phytochemical and biological studies led to generation of disciplines such as natural product chemistry and developing valuable natural therapeutic agents such as atropine, digitoxin, ephedrine, morphine, galanthamine, paclitaxel, artemisinin and so on [2]. In addition to supplying a rich and cheap source for new drugs, natural compounds possess unique properties making them more valuable.

For instance, many natural compounds such as curcumin, epigallocatechin-3-gallate (EGCG), resveratrol and quercetin have attracted researchers' attention with their multi-targeted mechanisms of action (a benefit making them appropriate for treatment of complex diseases such as cancer and cardiovascular diseases) [3,4]. Moreover, natural compounds are totally safer than synthetic ones. In the recent past, increasing researches in this area motivates pharmacognosists to find new sources of natural compounds such as marine creatures and microorganisms. Nevertheless, physicochemical properties of natural compounds are often less suitable for clinical use. In fact, a small portion of researchers' efforts to isolate active compounds from living organisms has been followed by new drug developments. Most of the isolated natural compounds have been pretermitted duo to their poor aqueous solubility, instability and susceptibility to fast degradation or oxidation, limited bioavailability and insufficient potency [5]. Does this mean that a large part of researcher's activities in this field along with great expenses lose?

The fact of the matter is that in many cases, medicinal chemistry through derivatizing of natural compounds successfully overcomes their physicochemical problems. However, is the tailoring pharmacokinetics of a natural compound by making changes in its molecular nature the only solution? Using novel formulations, researchers have recently attempted to improve pharmacokinetics of the natural compounds which are in importance. For example, Zhang et al. covalently attached paclitaxel to gold nanoparticles via DNA linkers. Solubility of conjugated paclitaxel has been 50fold higher than the free one [6]. Esmaili et al. prepared a nanomicelle formulation containing beta-casein to encapsulate curcumin. Using this system, they successfully enhanced solubility of curcumin 2500 times [7]. Lin et al. used a complex of liposome, polyethylene glycol and polyethyleneimine as a carrier for curcumin. In comparing to the free curcumin, the complex induced five-fold and twenty-fold higher cytotoxicity against curcumin-sensitive and curcumin-resistant cell lines respectively [8]. Various novel pharmaceutical systems as

nanoparticles, liposomes, micelles, and phospholipid complexes, drug encapsulated polymer nanoparticles, nanogels, etc. have been used to improve bioavailability, stability and efficacy of compounds such as curcumin, quersetin, sylimarin and so on [9]. By and by, researchers subject many other compounds that due to their poor physicochemical properties have had less chance to get noticed. The new collaboration between pharmacognosy and pharmaceuticals are returning many of natural compounds back to the drug pipelines. This evolving approach allows us to expect new areas for natural product research and successful delivery of many natural compounds to the market.

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