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## Development and characterization of sulforaphane conjugated gold nanoparticles for anticancer drug delivery

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**Purpose:** Sulforaphane (SFN) is a naturally occurring isothiocyanate found in high concentrations in broccoli. It is an anti-oxidant and a potent monofunctional inducer, which accounts for its anticarcinogenic properties in animal models. However the problem with SFN is its poor solubility, permeability and less stability. Many formulations of this are available in most countries. Thus, the idea was to develop an effective oral formulation of this drug with enhanced anticancer effect and enhanced stability and absorption profile.

**Methods:** Sulforaphane was extracted from commercially available broccoli and conjugated gold nanoparticles of SFN were prepared by electrolysis followed by homogenization cycles at 1000 bar pressure and optimization using design expert software. Simulations were performed and resultant structure was obtained. Particle size distribution and zeta potential were measured. The in vitro release study of the gold nanoparticle conjugates of SFN and SFN suspension was performed in phosphate buffer solution (PBS) by using a dialysis. Other studies such as SEM, TEM, Confocal studies, FTIR, DSC and stability studies were performed to characterize the prepared particles. The comparative in-vivo pharmacokinetic studies were carried out and analyzed by the established HPLC method. An MTT assay was used to assess the cytotoxicity was done on Caco-2 cells (ATCC, USA grown in Dabur Research Foundation, Sahibabad) and other carcinoma cell lines.

**Results:** DSC data confirms that drug has been incorporated with gold nanoparticles. Confocal studies reveal that the extent of permeation of sulforaphane conjugated gold nanoparticles i.e., SGnp has shown a threefold increase in permeation. Particle size measurement of simple gold NP before loading drug was measured and found to be  $7.58 \pm 1.34$  nm which was confirmed on TEM also. After loading the drug the size found to be  $156.0 \pm 1.89$  nm. FTIR Data reveals linking between drug and gold nanoparticles. Stability studies revealed stable formulations. MTT assays reveal that the formulations have cytotoxicity of more than 80% at 48 hours. The pharmacokinetic data revealed that the SGnp enhanced oral bioavailability as compared to plain sulforaphane by a factor of 4.5.

**Conclusion:** It can thus be concluded that gold nanoparticles gives an added advantage of greater stability, more cytotoxicity towards cancer cells and enhanced permeation through GIT. The cytotoxic potential of sulforaphane was supplemented by gold nanoparticles.

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## The necessity of new pharmaco-economic approach within North African region

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The North Africa region (including Algeria, Morocco, Tunisia, Egypt) by its social development and its capitalist opening to the huge drug market has experienced spectacular boom the last 20 years; granting to the pharmaceutical market a major role into the economic spectrum. The actual economic conditions, current financial situation all make the necessity of mastering and implementing a strong pharmaco medico economy application, as the cornerstone for optimal management of current resources to provide an improving quality of life and impeccable health commodities. This leads us to the necessity to get tamed with this policy that drives the economic approach and avoids any mismanagement of regional resources by ensuring the best way of countering the challenges of best funding and resourcing. The strategy to be adopted needs to focus on principal axes that will be described summarily furtherly.

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