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AYURVEDIC NATURAL EXCIPIENTS: AN ADVANCE OPTION FOR MODERN MEDICAMENTS

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ABSTRACT: Excipients are important partner in formulation that decide dosage form as well as Pharmacokinetics and pharmacodynamics of medicament. In contemporary era, excipients are used from synthetic resources, causes unwanted effect in pharmaceutics and therapeutics. So industries are looking towards natural resources as it delivers safe, biodegradable, cost effective, biocompatible and inert excipient to pharmaceutical industries. Leading organizations like WHO (World Health Organization), ICH (International conference on harmonization), IPEC (International Pharmaceutical Excipient Council) are working together to sort out the complication arises due to synthetic excipient and thus they are showing their faith inside traditional wisdom. In Indian subcontinent, *Ayurveda* is known medical sciences since 1000 BC and its existence till 21st century create a charm in contemporary scholar with a hope-light that *Ayurvedic* pharmaceutical wisdom shows a path for unique management of natural excipients. Interestingly, excipients in *Ayurveda* not only as inert supplements but also take part in pharmacological action. Here author investigated the concept of use, related pharmacokinetics and pharmacodynamics of natural nurture in *Ayurvedic* dosage form and their future prospect to assimilate *Ayurvedic* wisdom of natural excipients to contemporary dosage form to serve humanity by safe, efficacious, quality as well as cost effective medical supremacy on globe.

INTRODUCTION: Excipient are the substance or compound, other than the active pharmaceutical ingredient and packaging materials that affect finished product quality, in some cases making up almost entire formulation [1]. It also ensured the physical characteristic of medicinal product like weight, consistency and volume that are necessary for the correct administration of the active principle and alter some of pharmacokinetic profile too [2].

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Nature has provided us a wide variety of materials to help improve and sustain the health of all living things either directly or indirectly that is utilized as excipient thus names natural excipients.

Ayurvedic formulations are being admired, once again even in equivalence of its past glory on virtue of its holistic approach. Paramount parameters of quality, standard, safety and efficacy of *Ayurvedic* medicines (of majority) are in process of validation with continuity. Mandatory implementations of all these protocols are ensured by several government regulatory authorities with obligatory acceptance by business stakeholders of field with progressive attitude. *Ayurvedic* medicines are in practice since thousand years with all its exquisiteness of

systematic manufacturing of several dosage forms. It will be interesting to analyze number and nature of constituent's material given in most of formulations on different parameters of contemporary science of pharmaceutics. Conventionally, excipients are included in drug formulations as inert vehicles that provided the necessary weight, consistency and volume for the correct administration of the active ingredient, and performance of technological functions that ensure ease of manufacture [3]. Excipients play a contributory role in presentation of medicines on account of their pharmaceutical properties which will ultimately effect on pharmacokinetics and pharmacodynamics of medicines. Thus these have a considerable impact on therapeutic properties of drug.

In this review paper authors wish for a critical as well as reasonable analysis of constituency criteria of *Ayurvedic* medicines citing some examples of different dosage form of *Ayurvedic* formulations. Here we tried to establish genuine justification of number of ingredients therein in a given formulation with probability to search out natural excipients in them. Perception of excipients in ancient *Ayurvedic* dosage form and compulsions of the excipients in modern pharmaceutics are compared and analyzed all parameter of pharmaceutics. Nature has provided us a wide variety of materials to help improve and sustain the health of all living things either directly or indirectly. In recent years there have been important developments in different dosage forms for existing and newly designed drugs, natural products, and semi-synthetic as well as synthetic excipients often need to be used for a variety of purposes.

Natural polymers for pharmaceutical applications are attractive because they are economical, readily available, non-toxic, and capable of chemical modifications, potentially biodegradable and with few exceptions, also biocompatible [4]. Natural polymers and their semi-synthetic derivatives gained popularity in development of novel drug delivery systems as they are biodegradable, compatible with bioactive agents, readily available, and possess ability for chemical modifications. Synthetic excipients suffer with the problem of their unwanted harm to body, that's why researchers take more interest in development of excipient from natural resources [5]. In market, consumers look for natural ingredients in food, drugs, and cosmetics as they believe that anything natural will be more safe and devoid of side effects [6]. In contemporary science, excipient are pharmacologically inert substances having the primary role of diluents, binders, disintegrates, adhesives, glidents and sweeteners in solid dosage formulations like tablets and capsules. Polymer also has been successfully employed in the formulation of solid, liquid and semisolid dosage form and are useful in design of modified release drug delivery system [7].

This may be amazing to note that in *Ayurvedic* pharmaceutics, multi ingredient were included in same formulation to give maximum therapeutic effect as some are main ingredient and some may be considered as excipient in *Ayurvedic* formulation. So the concept of excipient is not new to the world of *Ayurveda,* as in reference of comprehensive research of excipients from authoritative book of D& C Act 1940 (The Drug and Cosmetic Act 1940) Schedule I, it was found that they were used since thousands of year with different names like *anupana, sahapana, prakshep, yogavahi* etc. in *Ayurvedic* science. Definition of excipient are changing over time and approaching toward concept used in *Ayurveda*.

Rationality in Concept of Excipient: Excipient, the term comprises with verb 'excipere' which means to receive, to gather or to take out [8]. This refers to one of the properties of an excipient, which ensure the medicinal product has the weight, consistency and volume necessary for the correct administration of the active principle. This historically somewhat limiting definition referred to those substances employed in preparation of tablet, capsules up to 1940 and USP 10 also mentioned lactose, glucose, lycopodium, glycerin and gelatine [9]. In 1957, excipients were defined as 'the substance used as a medium for giving a medicament', that is to say with simply the functions of an inert support of the active principle or principles [10]. Again, in 1974 they are described as 'any more or less inert substance added to a prescription in order to confer a suitable consistency or form to the drug: a vehicle [11].

To the function of simple vehicle, galenic science then added that of adjuvant in the carrying and release of the active principle of the formulation. Looking at the matter from this angle, the United States' National Formulary of 1994 states that an excipient is any component other than the active principle added intentionally to the medicinal formulation, or everything in the formulation except the active drug [12].

WHO define excipient as the substance other than active ingredients which have been appropriately evaluated for safety and or included in a drug delivery system [13] to

1. Aid in processing if drug delivery system during its manufacture.
2. Protect, support and enhance stability, bioavailability or patient acceptability.
3. Assist in product identification
4. Enhance any other attribute of the overall safety and effectiveness of the drug during storage or use.

International Pharmaceutical Excipients Council (IPEC) defined excipients as the other substances in the pharmaceutical formulation than the active pharmaceutical ingredients (API) which have been appropriately evaluated for the safety in order to help in processing, manufacturing, protection and give support or to enhance stability, bioavailability or patient acceptability or to assist in product identification or improve any features of the safety or effectiveness of the drug delivery system during storage or use [14]. In *Ayurvedic* science, since clear cut description on the name related to the excipient was not found as such because of science driven by the concept that each natural material have *Panchmahabhoota* composition (*Prithvi*, *Jala*, *Agni*, *Vayu* and *Akash*) and have unique *Rasa, Guna, Virya, Vipaka, Prabhava* and *Karma* and every natural material have some property that may help in maintaining health as well as curing disease [15]. But in light of comparison with contemporary science, many ingredients in the *Ayurvedic* formulation may be considered as excipients that complies with recent concept of excipient.

Concept of Excipients in *Ayurvedic* Pharmaceutics: *Ayurvedic* methodologyis framed on the concept of *Trisutra* i.e. *Hetu* (etiology), *Ling* (sign & symptoms) and *Aushadh* (medicine), that are the three pillars for healthy as well as diseases persons [16]. Among them *Aushadh* is considered as prime importance for the sake of diseased persons and also as instrumental aid to the physician and placed under *Chikitsachatuspada* (four basics of practice of medicine) [17]. On the basis of origin these are categorize in to plant, metals & minerals and animals and by the use of suitable technology they are converted in desired formulations for administration in patients. Groups of classics known as Greater triad (*Brihattrayee*) and Lesser triad (*Laghutrayee*) are noteworthy in which many formulations are given and indicated to create formula as per patient strength and disease strength. *Ayurvedic* physicians have mainly relied on a combination of drugs rather than a single drug. Administration of drugs in combination (*samyoga*) may either enhance or antagonize the response of the individual component.

The mutually supporting or enhancing aspect of combinations is known as synergistic (*sarvakarmaja*) and opposite, the antagonistic effect (*dwandwakarmaja*). Some preparations with food articles fortified with medicines like *lehya*(confectionaries), *utkarika*(bolus), *shashkuli*, etc. were made to have the acceptability of sensitive patients having aversion to take the medicines. Formulations were prepared according to the need of the stage of the disease also, as various *Guggulu* preparations were formulated by treating the *Guggulu* with different selective drugs according to the need, for example *Kanchanara Guggulu* to treat lymphnodular swellings, *Triphala Guggulu* for obese patients with arthritis and *Punarnava Guggulu* for arthritis associated with excessive swelling of the joints. It appears that ancient scientists used complex methods for selective extraction of different phyto-constituents for selective use [18].

The original *Charak Samhita kalpasthana* and *siddha sthana* was added by Dridhabala which add 12 chapter containing formulation mainly adding substance which may be define under column of excipients and design group of medicine on the basis of type of ailment and strength of the patient[19].

When we think about designing of formulations, it is observed that number of ingredient varies from

one text to another along with their indication, out of them some ingredients are targeted as per etiopathology of that disease, some act as agonist/ antagonist activity and some are necessary for designing of particular dosages form as binder for manufacturing of *vati*, sweetening agent in case of *Avaleha*etc, carrier for active ingredients, bioenhancers, etc. *Ayurvedic* formulation made up of several ingredients that are classified into main ingredient, supportive ingredient, bioenhancers, binders, synergism (*Yogavahi*), antidotal (*tankana* for *vatsanabha*) etc. After critical analysis of Ayurvedic dosages formmeant for internal administration from *Snehakalpana* (medicated oils) to *Sandhankalpana* (biomedical fermented formulation) it is observed that lipid substance may act drug delivery substances in spite of its nutritive and medicinal value while alcoholic milieu play role in bio absorption and faster distribution of drugs along with their capability to energize the bio-system. *Vati* kalpana (tablet like dosage form) which are more frequently prescribed for its unique features and its pharmaceutics cannot possible without help of binding agent.

Natural binders like different *starches, gums, mucilage*, dried fruits possess binding capacity as well as some other properties like disintegrants, filler, sustain release, and these natural polymers are much safer and economical. Natural polymer like starch, pregelatinized starch, gelatin, acacia, tragacanth and gums are used as binding agent [20]. During the preparation of *vati*, Water and *Gomutra* (cow urine) are use as *bhavna* dravya in which the liquid got self-evaporated. Cow urine used at many places in *Ayurveda*, in *shodhan* (purification), *bhavana* (levigation) etc. which is reported as bioenhancers [21]. In contemporary science bioenahcer and binder is reported as excipient. In most of the *Ayurvedic* dosages from *prakshepdravya* are used for improving the efficacy palatability along with their pharmacokinetics which includes many ingredients like *shunthi, marich, pippali, honey* etc. *Pippali* (ingredient of *Trikatu*) [22], *trikatu*etc are having bio enhancing propertieshence these may be considered as excipient in contemporary science [23].

In few Ayurvedic dosages *trijatak, chaturjatak, manjistha* etc are used as flavoring agent according to need of patients i.e. in case pediatric preparation these may be added for better palatability so that child can take it easily e.g *Avaleha*, syrup etc. In *sandhan Kalpna* (biomedical fermented formulation), alcoholic substances are formed during their pharmaceutical processing and these are responsible for better absorption of medicament and may also act as preservative [24]. Overall it is observed that these formulations are designed in such a manner that some ingredients play major role as per disease condition, some may potentiate the action of main drugs, some act as drug delivery system and ingredients may also interact to each other to nullify to adverse effect of other and finally produce beneficial effect to mankind.

After comprehensive analysis of literature in Ayurveda, we found that there are many ingredients that can be called as probable excipient (**Table 1** and **2**). Most of time during metallic and herbo-mineral formulation, herbal drug, water, *tail*, *kanji*, cow urine etc. are used for their processing to make it free from toxicity along with addition of some properties viz. brittleness, porosity, increase surface area due to the presence of herbal exudate like tannins, alkaloid etc.

TABLE 1: PROBABLE EXCIPIENTS IN *AYURVEDIC* DOSAGE FORM

Sr no.	Ayurvedic dosage form	Probable excipients in correlation with Guideline of IPEC
1	*Swarasa*	*Prakshep*dravya
2	*Kalka*	*Prakshep*dravya
3	*Kwath*	*Prakshep*dravya and anupana
4	*Churna*	supportive ingredient for taste and flavour, Anupana, sahapana
5	*Vati*	Smoothing agent like *ghee* and some in-situ constituents of herbal, mineral and animal origin, *Bhavna*dravya, sometimes enhancer, binder,
6	*Avaleha*	In-situ constituents of herbal, mineral and animal origin, Sugar, *prakshep*dravya, ghee, tail
7	*Snehadravya*	Some herbal constituents, water entrapped micelles, Tail, *Ghee*(Lipid content)
8	*Asava/ Arista*	Self-generated Alcohol during pharmaceutical procedure and some herbal constituents, water

These formulations were indicated to take with *anupana*, *sahapana* and supporting media that may be considered as excipient. In some metallic preparation *bhavna* dravya were used that cause chelating in its final product to give less toxic medicament (e.g. *Triphalakwath* in *loha* (iron) *shodhan* process chelates copper and iron and reduces UV-induced erythema) [25]. In *bhasma* preparation the herb used during processing as *bhavnadravya* also remain after *bhasmikaran* process that cause agglomeration with metallic medicament and probably encircled it [26].

So the concept of excipient in *Ayurvedic* prospective is reflecting the vigorous use of natural products. In *Ayurveda* the concept of excipient as bioenhancers is being used since centuries and is called "*Yogvahi*" e.g. is the use of "*Trikatu*". Black pepper is supporting evidence where piperine was one of the ingredients as "*Yogvahi"*. Bioavailability and absorption enhancement through co-administration of drugs with naturally occurring compounds from plants are considered to be very simple and relatively safe. They increase the bioavailability and absorption of the co-administered drugs. Uses of bioenhancers are also applicable in veterinary practice since bioavailability of drugs and nutrients is of equal relevance to animals as to humans [27].

Since term nearer to excipient was not used as such in the *Ayurvedic* classics but the concept of excipient was totally followed and dictated in these *Shastra* (texts). The multi-ingredient approach and use of supportive ingredient along with supporting media for dosage form and administration are in compliance of the excipient concept. Probable excipient mentioned in **Table 2** with respect to the formulation is not limited to the table but it is only some example taken here as example. These ingredients play their role in the formulation as depicted in remark column of **Table 2** and thus involve in framing of dosage form or in pharmacokinetics or supportive pharmacodynamics along with main ingredients of formulation.

TABLE 2: PROBABLE EXCIPIENTS IN AYURVEDIC FORMULATION

S.no.	Formulation	Probable excipient	Remarks	References
1.	*Amrita swaras*	Honey, Turmeric	Prakshepdravya	Sha. S. M 1/7
2.	*ShunthiPutapaka*	Honey, Sugar	Prakshepdravya, Sahpana	Sha. S. M 1/42-44
3.	*Abhayadi Kwath*	Pippali	Sahpana, prakshep	Sha. S. M 2/ 32-34
4.	*Mustadi Kwath*	Honey, Pippali	Prakshepdravya	Sha. S. M 2/52
5.	*Amradi Phant*	Honey	Sahapana	Sha. S. M 3/6
6.	*Dhanyak Hima*	Sugar	Sahapana	Sha. S. M 4/7
7.	*Vishnukranta Kalka*	Honey, sugar and ghee	Prakshep, sahapana	Sha. S. M 5/17
8.	*Sitopaladi Churna*	Honey, Ghee, Sugar	Sahapana, sweetener	Sha. S. M 6/136-139
9.	*Mandur Batak vati*	Cow urine, takra	Bhavana, anupana	Sha. S. M 7/34-36
10.	*Arshoghnivati*	Jala	Bhavana Dravya	Bhai. R. Parisista /33-36
11.	*Krimivinashana rasa*	Adrakswarasa	Bhavanadravya	Bhai. R. 11/40-42
12.	*Kuberakshadi Vati*	Jala	Bhavana Dravya	Bhai. R. Parisista/57-60
13.	*Pushpadhanva rasa*	Mulethi	Sweeteners / Flavors	Bhai. R. 74/70
14.	*Prataplankeshwa rasa*	Adrakswarasa	Bhavanadravya	Bhai. R. 5/839-857
15.	*Amrita vati*	Jala	Bhavana Dravya	Bhai. R. 10/99
16.	*Eladigutica*	Dalchni, Mulethi, Pippali	Flavors, Sweeteners, Flavors, Bioenhancer	Bhai. R. 13/42-45
17.	*Shirishadianjan*	Gomutra	Bioenhancer	Bhai. R. 9/236
18.	*Sanniptabhairav rasa*	Adrakswarasa	Bhavanadravya	Bhai. R. 5/732-733
19.	*Saubhagyasunthipaka*	Dhanyak	Flavors	Bhai. R. 61/25-28
20.	*Shirishadianjan*	Gomutra	Bioenhancer	Bhai. R. 5/236
21.	*Mahashankhvati*	Amla juice	BhavanaDravya	Rasamritam 9/135,136
22.	*Shankhadichurna*	Trikatu	Bioenhancer	Rase. Sa. San. 3/65,66
23.	*Narikelkhand*	Dhanyak, Dalchni	Flavors	Bhai. R. 30/233-234
24.	*Sanjivanivati*	Gomutra, Adrakswarasa	Bhavanadravya/ Anupana	Sa. S. M 7/18-21
25.	*Yogarajguggulu*	Dhanyak and Dalchni	Flavors	Chakradatta 25/27-32

[Sha. S M (Sharangadhar Samhita Madhyam Khand), Bhai R (Bhaisajya Ratnawali), Rase Sa. San (Rasendra Saar Sangraha)]

Role of Excipient in Development of Dosage Form: Today manufacturers have several pharmaceutical excipients of plant origin, like starch, agar, alginates, carrageenin, guar gum, xanthan gum, gelatin, pectin, *acacia*, tragacanth, and cellulose. These natural excipients find applications in the pharmaceutical industry as binding agents, disintegrates, sustaining agents, protective add, colloids, thickening agents, gelling agents, bases in suppositories, stabilizers, and coating materials. Natural excipients can be utilized in sophisticated drug delivery system based on their properties viz polysaccharide (degradable in colon by microbial flora), pectin (ethyl cellulose film make it colon drug delivery system, control fragrance release), alginate (matrix type alginate gel beads, in liposomes, in modulating gastrointestinal transit time, for local applications and to deliver the bio molecules) and gums (for different NDDS application) [28]. Both synthetic and natural polymers are available but the use of natural polymers for pharmaceutical applications is attractive because they are economical, readily available and non-toxic.

They are capable of chemical modifications, potentially biodegradable and with few exceptions, also biocompatible [29]. The specific application of natural polysaccharide polymers in pharmaceutical formulations include to aid in the processing of the drug delivery system during its manufacture, protect, support or enhance stability, bioavailability or patient acceptability, assist in product identification, or enhance any other attribute of the overall safety, effectiveness or delivery of the drug during storage or use [30].

With the time, *Ayurvedic* dosage form are becoming more advance and their chronological development from *swarasa* to most recent capsule, aerosol, novel drug delivery via *Churna (*powder), *Kwath (*decoction), *Sneha*(oil preparations), *Asava-Arista* etc. is generally based on the excipient used therein for their suitability for administration as well as pharmaceutico-therapeutics. There are five basic *kalpana* (pharmaceutical dosage form) in *Bhaisajya Kalpana* in which some ingredients were also work as excipients and some were indicated too take with formulation also indicate excipients. *Swarasakalpana* was basic dosage form in which use of some *prakshepdravya* was also mentioned either for enhancing therapeutics or for taste to make it palatable [31]. *Kalka* (paste) was next to *swarasa* which includes plant fiber along with extract, and to enhance taste some excipient was added where plant fiber is naturally supplied excipient. *Kalka* to cold maceration (*Shrita* kalpana) is for substance that cannot be taken as whole, in spite it was converted into liquid formulation and taken as per taste of interest. Decoction is done for the material whose extraction require for their effect (hard and dried materials mostly) and it involve heating for time saving and for maximum yield of extract. Phantdosage form developed for those whose active principles are either lost on boiling or not properly extracted in cold with time dependency. In *churnakalpana* some taste and flavoring agent are added along with bioenhancers and indicated for their use with suitable vehicle. *Snehakalpana* cannot be assumed without use of *tail* (oils), it acts as a carrier for lipid soluble ingredient as well as water soluble ingredients in the form of liposome and noisome.

They are act as carrier for applying on those surface which are resistible to absorption in deep tissues [32]. *Asavaarista* dosage form was developed for giving faster absorption and distribution along with to energize the bio system and used for ingredients whose alcoholic extract was required for therapeutics. The alcohol generated in these formulation act as driver for bio absorption, enhancing bioavailability and to increase shelf life of the formulation. Self-generated alcohol also serves as hydro alcoholicmilieu for continuous extraction and preservation of the extract suspended in formulation[33].

In *Ayurvedic* pharmaceutics some formulations have low dose, so difficult to convert into unit dose so diluent was used like *Marich (Piper nigrum)* used in case of *Gauripasana*. The stability period also enhanced by using several type of excipient as preservative, self-generated alcohol (*Sandhan Kalpana*), Sugar (*Avaleha*), oils/lipids (*Sneha Kalpana*) etc.

Now days conventional modern pharmaceutics are touching the novel drug delivery through use of excipient as carrier for control drug delivery system as Gellan gum (microbial origin), Scleroglucan (marine origin) and chondroitin sulphate from

animal origin have been used. Locust gum and xanthan gum are widely used in development of sustain released formulation [34]. *Ginger* used as binder and bioenhancer and when used with different antibiotics (azithromycin, erythromycin, cephalexin, cefadroxil, amoxicillin) [35].

In contemporary science, Pharmaceutical processing depends on many factors, Nature of the raw material either fresh or dry, required concentration of the dosage form, solubility of therapeutically useful component of the plant, heat stability of therapeutically useful component of the plant, route of administration and shelf life of prepared dosage form [36]. So the formulation development is inclusive of market response, consumer acceptance, their age relation, ADR of excipient - Drug, ADME of drug and pricing. So excipient play major role with their contribution in above factors. Drug nanoparticle formulation using ascorbic acid derivatives (ascorbyl glycoside) used not only as antioxidant but also as carrier compound [37].

Natural polysaccharides are often incorporated in the design of controlled drug delivery such as those target delivery of the drug to a specific site in the gastro intestinal tract (GIT), this can be achieved by various mechanisms including coating granules, pellets, tablets with polysaccharides having pH dependent solubility, or incorporating non-digestible polysaccharides that are degraded by bacterial enzymes present in the colon, this property makes these polysaccharides potentially useful in the formulation of colon-targeted drug delivery systems [38].

Classification of Excipients: Natural excipients are chemically heterogeneous compounds that range from simple molecules (water) to complex mixtures of natural, substances which, from the regulatory point of view, may be subdivided into three categories. In the first category (approved excipients) we find the compounds originating from the food industry (generally recognized as safe: GRAS) or that have been present in pharmaceutical products for a very long time. The intermediate category (essentially new excipients) covers compounds obtained by means of the structural modification of the excipients already approved or those already used in the food or cosmetic industries. The third category covers new compounds, never previously used in the pharmaceutical field and it is growing rapidly due to the present interest in modified-release formulations and the requirements of the modern high-productivity compressing/ tableting machines [39]. They are classified on the basis of their origin (**Table 3**) [40], their chemical and role (**Table 4**) [41], and also as per rule 169 of Drug & cosmetic Rule 1945 excipients are permitted in *Ayurveda* (**Table 5**) formulation along with their standards permitted in IP, Prevention of Food Adulteration Act 1954 and Bureau of Indian standard act 1986 [42].

TABLE 3: CLASSIFICATION OF EXCIPIENTS ON THE BASIS OF SOURCE OF ORIGIN

From animal	From vegetable	From minerals	Synthetic
Beeswax, Cochineal,	Kokum butter, Pectin,	Bentonite, Kieselghur,	PEGs,
Gelatine, Honey,	Starch, Peppermint,	Kaolin, Paraffins,	Polysorbates,
Lactose, Spermaceti,	Cardamon, Vanilla,	Talc, Calamine,	Povidone,
Lanolin, Musk, Suet etc	Saffron, Guargumetc	Fuller's earth, Asbestosetc	

TABLE 4: CLASSIFICATION ON THE BASIS OF ITS CHEMICAL NATURE

Sr.	Chemical basis for classification	Role to enhance
1.	Water, Alcohols,	Compliance
2.	Esters, Ethers, Carboxylic acids	dose precision and accuracy
3.	Glycerides and waxes	Stability
4.	Carbohydrates (mono-, di- and polysaccharides)	Manufacturability
5.	Hydrocarbons and halogen derivatives	Tolerability
6.	Polymers (natural and synthetic)	Disaggregation
7.	Minerals	Dissolution
8.	Protein	controlled release
9.	Various: preservatives, dyes, sweeteners, surfactants	Absorption

TABLE 5: CLASSIFICATION OF EXCIPIENT AS PER D&C RULE 1945

Sl. no. & Category	Permitted Excipients	Reference Standard/Grade
A. Additives	Activated Charcoal, Beewax, Cellulose & its derivatives, Soft Paraffin, Carnauba Wax, Beeswax	IP
	Agar, Arachis Oil, Calcium Carbonate	PFA
	Calcium Phosphate Dibasic, Calcium Phosphate Tribasic	IP
	Citric acid & its salts and Tartaric Acid & its salt and Yeast	PFA
	Stearic Acid & its salts and Starch & its derivatives	IP
	Xanthan Gum	USNF
	Zinc oxide, Carbomer, Colloidal Silicon Dioxide, Talc, Sucrose,	IP
B. Preservatives	Acetic acid, Benzoic acid & its salts	PFA
	Butyl paraben, Ethyl paraben	BP
	Methyl Paraben& its salts and Propionic acid & its salts	PFA
	Phenyl mercuric nitrate	IP
	Propyl paraben& its salts and Sorbic acid & its salts	PFA
C. Antioxidants:	Ascorbic acid & its salts &esters, Potassium metabisulphite, Sodium metabisulphite	PFA
	Butylated hydroxyl toluene, Gallic acid esters	PFA
D. Colouring agents:	**1. Natural colours**: Annatto, Carotene, Chlorophyll, Cochineal, Curcumin, Red oxide of Iron, Yellow oxide of Iron (Titanium oxide), Black oxide of Iron	Rule 127 of Drugs and Cosmetics
	2. Lakes – the Aluminium or calcium salts (lakes) of any water soluble colours.	Rules 1945
E. Flavouring agents	As permitted under Fruit Product Order and PFA Act, Rule 163.	
F. Alternate Sweeteners:	Artificial sweeteners may be used for only in proprietary ASU products. Sucralose, Aspartame, Saccharin, Acesulfame K	As in Fruits Product Order

Cross in thought process: *Ayurveda* is known medical sciences since 1000 BC and it existence till 21st century create a charm in contemporary scholar with a hope-light that *Ayurvedic* pharmaceutical wisdom show a path for unique management of natural excipients. Concept of use of natural resources and their modification toward dosage form in the context of personalized approach was well dictated in Authoritative *Ayurvedic* text. This is the time when *Ayurvedic* pharmaceutics look into science and art of drug designing through spectacle of contemporary science and technology while the scholar of contemporary science outsourcing the ancient wisdom for several reason.

In one side *Ayurvedic* pharmaceutics adopting contemporary pharmaceutics to convert ancient dosage form into demanding dosage form. Due to the advances in drug delivery technology, natural polysaccharides are included in controlled drug delivery to fulfill multitask functions and in some cases directly or indirectly influence the extent and /or rate of drug release. The advantages of natural excipients over the synthetic one can be listed as biodegradable, non-toxic, having low cost, environmental friendly, local availability, better patient acceptance, mostly they are from edible sources. On the other hand, there are some disadvantages like microbial contamination, batch to batch variation too [43]. Still people from contemporary science looking into natural science because of advantage like trust of human, devoid of ADR etc. Total market of drugs is largely influenced by excipient cost as it gives base/ size for the drug in most cases. To develop advance drug delivery system with natural excipient is need of time because manufacturers are losing interest in synthetic excipient due to its demerits.

Function of Natural Excipient: Natural excipients have their unique role in drug formulation in addition to their specific pharmacokinetics and pharmacodynamics. The probable use and the mechanism of action of the natural excipient were mention in **Table 6** [44-51]. Excipients can also be categorized on the basis of their chemical interacting function in the formulation **Table 7** [52].

TABLE 6: ROLE AND MECHANISM OF ACTION OF NATURAL EXCIPIENTS FROM AYURVEDIC PHARMACEUTICS

Sr. no.	Name of excipients	Probable use	Mechanism of action
1.	*Guggulu, Amra*	Binding agent/ adhering agents	Adhesive binding
2.	*Sita (Sugar)*	Sweetener	Act on taste bud, As preservatives
3.	*Ela/ Dalchini/ Karpura/*	*Sugandhit* dravyas	Act on olfactory system
4.	*Raktavargadravyas*	Colouring agent	Extract leaves colour
5.	*Piperine (Marich/ Pippali)*	Bioenhancers, increase bioavailability, increase efficacy	Act over cytochrome P 450 thus inhibitor of drug metabolism, Inhibit AHH, UDP glucuronyl-transferase activity.
6.	*Tankan*	Antidotal agents	-
7.	*Jala/ Water*	Binding agents	Make coherent mass and sometimesas medium
8.	*Chitosan (Trimethylated)*	Absorption enhancer	Increase drug absorption via paracellular route by redistribution of F actin, causing opening of tight junction
9.	*Ginger, potato starch, Acacia*	Bioenhancer, Binder	Adhesive for binder and effect on GIT mucosa
10.	*Trikatu*	Bioenhancer, Absorption enhancer	Increase GIT blood flow, Rate of transportation across GIT mucosa
11.	*Coriender, Manjisthaetc*	Flavouring agent	Olfactory organs
12.	*Cow urin*	Bioenhancer	
13.	*Caster oil derivatives (cremophor EL etc)*	Non ionic surfactant	Inhibition of active transporter
14.	*Andrographolide, Kaempherol, quercetin, gingerol, luteolin*	Excipients	Intracellular signal transduction, Inhibition of P 3 kinase
15.	Algenic acid, Cellulose	Thickening agent, binder, disintegrating agent	Adhesion, swellowing, hydrophilic nature

TABLE 7: EXCIPIENTS AND THEIR CHEMICAL FUNCTION USED IN AYURVEDIC AND CONVENTIONAL PHARMACEUTICS

Sr. no	Excipients function	Example
1.	pH modifier	Citric acid, Tartaric acid, Benzoic acid
2.	Water soluble organic solvents	Polyethylene glycol 300 & 400, Ethanol, Propylene glycol, Glycerin, N-methyl 2-pyrrolidone, Dimethyl acetamide
3.	Water insoluble organic solvents	Beeswax, D-a tocopherol, Oleic acid, Mono & di glycerides
4.	Nonionic surfactants	Cremphor, Tween 20, Sorbitanmonooleate, Peppermint oil, Polysorbate 20 & 80
5.	Water insoluble lipids (triglycerides)	Peanut oil, Corn oil, Soybean oil, Sesame oil, olive oil and cotton seed oil
6.	Phospholipids	Glycerol, choline, DSPG, DMPC
7.	Cyclodextrins	a-cyclodextrins, b-cyclodextrins, Sulfobutylether-cyclodextrin, Hydroxypropyl-cyclodextrin

Safety Issue in Excipient: Natural excipients are generally safe as it is Biodegradable, Biocompatible and non-toxic – Chemically, Economic, Safe and devoid of side, Easy availability with some advantage like Microbial contamination, Batch to batch variation, the uncontrolled rate of hydration, slow process and heavy metal contamination [53].

Less attention has been devoted to the safety of excipients, because their inertia and inequity were taken for granted. The continual evolution of pharmaceutical technology, with the growing use of new 'tailor-made' materials, suggests to take a new look at the so-called pharmacological and toxicological inactivity of these components of pharmaceuticals for ensuring safety [54].

The most important part of a medicine as far as its weight is concerned, is constituted by its excipients, which have the important functions of guaranteeing the dosage, stability and bioavailability of the active principle. The components employed as excipients must present the characteristics required by their technological function but, as with any substance administered to man, they must also correspond to suitable safety requirements. Indeed, in this case, the International Toxicological Committees (among which the Joint Expert Committee on Food Additives, a mixed committee of the WHO/FAO) demand thorough studies in laboratory animals, with the intent of protecting the consumer's safety.

We shall examine three issues that may compromise the safety of pharmaceuticals: (a) production, distribution and use; (b) pharmaceutical-excipient interactions; and (c) toxicity, which may be the cause of frequent and sometimes notable 'adverse effects. Side effects imputable to excipients were already noted in the 1930s, as in the case of an elixir of sulphanilamide [55].

It is also to be borne in mind that the ratio of their weight to that of the active principles is usually very high in a formulation, and such as to cause possible action due to their mass. Like pharmaceutical drugs, excipients too have their own thermo-dynamic activity which can contribute to reactions leading to degradation or to interactions between the drug and the excipient [56]. Here, natural excipients used in *Ayurveda* have upper hand in term of safety since till date no data is presented which suggest that *Ayurvedic* excipient showed any toxic effect.

Regulatory Bodies and Regulations for Excipients: Since excipients are the integral component of drugs in synthetic as well as modified dosage form so the demand of the excipient in pharmaceutical industry is very much boomed and searching the quality and suitability of the excipient is burning issue as sometimes excipient content in formulation is more than active pharmaceutical ingredients. In the era of globalization and commercialization, it is necessary to ensure quality, safety and cost effective excipient for which several regulatory organization and notifications play their role in regulation across. In Asia Japanese pharmacopoeia contain 31 excipient monograph while USP-NF contains 41 excipient monograph and 28 chapter for harmonization [57]. World Health Organization through its technical report 885:1999, provides guideline, definition of the pharmaceutical excipient in addition to the quality safety and their required standards. ICH produces its ICH-Q8(R2) guideline for excipient and its relevancy in drug development [58]. IPEC (The International Pharmaceutical Excipients Council) an international industry association formed in 1991 by manufacturers, distributors and end-users of excipients. By the end of 1992 with the collaboration of Japan and UK a 'tri PEC' was formed while later china join hand in 2008. IPEC federation was formed in 2010 officially having member IPEC-Americas, IPEC-Europe, IPEC-Japan and IPEC-China. IPEC India is now in the process to be a key player and is in the formation stages. IPEC India will work actively to promote excipients safety and harmonization of regulatory standards and pharmacopoeial monographs [59, 60].

The excipient certification scheme (EXCIPACT) was launched in May 2008 with EFCG (European Fine Chemical Group) and IPEC Europe, now comprises 5 trade associations 1. FECC European Association of Chemical Distributors 2. IPEC-Americas (International Pharmaceutical Excipients Council Americas) 3. IPEC-Europe (International Pharmaceutical Excipients Council Europe) 4. PQG-UK (Pharmaceutical Quality Group) 5. EFCG with the aim to more safety (through certified compliance to recognized GMP and GDP standard), Cost and time savings (only a single audit is needed to prove GMP/GDP compliance) and Worldwide acceptance (building on existing ISO standards, and supported by major industry organizations) [61]. EXCIPACT is regulated by three rules as EXCIPACT GMP and EXCIPACT GDP as per Annex to ISO 9001:2008 and third newly NSF/IPEC/ANSI 363-2014 (Also known as ANSI 363). In present EXCIPACT GDP define GMP too for distributor of excipient. Here supplier have option of being audited under ANSI 363 or EXCIPACT standard or ISO 9001[62, 63].

GMP requirements for excipients are stipulated in the "Joint IPEC-PQG Good Manufacturing Practices Audit Guideline for Pharmaceutical

Excipients" by IPEC and PQG (Pharmaceutical Quality Group). This guideline, which is structurally based on the ISO 9001 standard, is now universally recognized and accepted [64]. The import and regulation of excipients in India is being done by CDSCO (Central Drugs Standard Control Organization) through "Guidance Document IMP/REG/200711 entitled Guidance document on common submission format for import and registration of bulk drug and finished formulation in India [65]. In addition to these guideline, rule 169 of Drug & cosmetic Rule 1945 excipients present permitted excipients in *Ayurvedic* formulation (As shown in **Table 5**) along with their standards permitted in IP, Prevention of Food Adulteration Act 1954 and Bureau of Indian standard act 1986 [66].

Globalized Market of Excipient: According to the publication" "Excipients Market Global Industry Analysis, Market Size, Share, Trends, Analysis, Growth and Forecast, 2012 -2018" the global excipients market, which was valued at US$5,260.0 million in 2011, is expected to be worth US$7,586.6 million by the end of 2018 Driven by factors such as the expansion of the pharmaceuticals market, the global excipients market is poised to grow at a 5.4% CAGR between 2012 and 2018 [67]. In market research report "Pharmaceutical Excipients Market by Products (Organic chemicals, Inorganic Chemicals), Functionality (Fillers, Binders, Lubricants, Preservatives), & by Route of Administration (Oral, Topical, Parenteral, Others) Global Forecast to 2019", published by 'Markets and Markets', the pharmaceutical excipients market is expected to reach around $8,439.0 Million by 2019 at a CAGR of 6.7% during the forecast period from 2015 to 2019 [68].

CONCLUSION: Excipient, a partner of the API in a dosage form meanwhile have major share in a formulation sometimes and showing their unique pharmacokinetics and pharmacodynamics apart from Active Pharmaceutical Ingredients to complete the motive of medicine. Human, a creation of nature is well supplied with natural materials that were used as medicament too since thousands year even in many traditional medical sciences including *Ayurveda* in India. In contemporary science, synthetic excipients were developed and widely used in dosage form till 20th century but when the cost and safety was questioned they start looking towards traditional wisdom to understand the concept of use of natural nurture in dosage form compromising some disadvantage. *Ayurvedic* system of medicament is in demand with strict regulation of countries raise need of advancement in dosage form with natural supplied excipient. In this regards these natural excipients used in Ayurvedic pharmaceutics may play a major role as advance nurture for Ayurvedic medicament as well as modern medicaments to fulfill the requirement of time demanding dosage form with quality, safety and efficacy along with cost effectiveness and serve the creation of nature by its natural nurture and medicament.

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CONFLICT OF INTEREST- Nil

REFERENCES:

1. Anonymous: WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fortieth report, Geneva: World Health Organization; 2006. WHO Technical Report Series No- 937:183.
2. Pifferi G and Restani P: The safety of pharmaceutical excipients. Il Farmaco 2003; 58:541-50.
3. Manjanna KM, Kumar TMP andShivakumar B: Natural polysaccharide hydrogel as novel excipient for modified drug delivery system: a review. Int J Chem Tech Res2010; 2: 509-25.
4. Coviello T, Matricardi P: Polysaccharide hydogels for modified release formulations. J control release 2007; 119: 5-24.
5. Kumar S, Gupta S K: Natural polymer, gum and mucilage as excipient in drug delivery. Polim Med 2012; 42:191-197.
6. Dharmendra S, Surendra JK, Sujata M and Shwera S: Natural excipient: A review. Int J Pharma & bio archives 2012; 3: 1028-34.
7. Guo J, Skinner GW, Harcum WW and Barnum PE: Pharmaceutical applications of naturally occurring water-soluble polymers. PSTT 1998; 1:254-61.
8. Pifferi G and Restani P: The safety of pharmaceutical excipients. IL Farmaco 2003; 58: 541-50.
9. Winek C L: History of excipient safety and toxicity. Drugs Pharm Sci2000; 103:59.
10. Morton: The Nurse Dictionary. London: Faber & Faber, 24th edition 1957.

11. Dorland: Dorland's Medical Dictionary. Philadelphia: WB Saunders, 25th edition 1974.
12. Blecher L: The formation of the International Pharmaceutical Excipient Council. Pharm Technol 1991; 15 :54-6
13. Anonymous: Good manufacturing practices: supplementary guidelines for the manufacture of pharmaceutical excipients. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Thirty-fifth report. Geneva: World Health Organization; 1999: Annex 5 (WHO Technical Report Series, No. 885).
14. Apte S P and Ugwu S O: A review and classification of Emerging excipients in parenteral medications. Pharmaceutical Technology 2003; 27:46.
15. Sharma PV: Dravyaguna Vijanana Vol-1. Choukhambha Bharati academy Varanasi, 2006.
16. Charak: Charak Samhita Sutrasthana 1/24.
17. Charak: Charak Samhita Sutrasthana 9/3.
18. Lavekar G S: Scientific Validation of Drug Development and Clinical Research in Ayurveda. 05-AYU-N5. PM70; 2006.
19. Anthony Cerulli: Somatic Lessons: Narrating Patienthood and Illness in Indian Medical Literature. SUNY Press 2011. p. 37.
20. Patel S, Agrawal S and Singh L B: Natural Binding Agents in Tablet Formulation**.** Int J Pharm & Bio Archives 2012; 3:466-73.
21. Randhawa G K: Cow urine distillate as bioenhancers. JAIM 2010; 1: 240-41.
22. ThakurM, Porwal P, Pal P, Shukla K and Mahajan S C: Development of standardization of trikatu churna: A spectrophotometric approach. Int J of Pharm & Life Sci 2012; 3: 2254-58.
23. Atal CK, Dubey RK and Singh J: Biochemical basis of enhanced drug bioavailability by piperine: evidence that piperine is a potent inhibitor of drug metabolism. J Pharmacol Exp Ther 1985; 232: 258-62.
24. Sreelal A M, Basavaraj G and Reshma S M: Critical analysis on pharmaceutics of alcoholic preparations (asava-arishta) in Ayurveda. JAHM 2013; 1:15.
25. Krishnamachary B, Purushothaman A K, Pemiah B, Krishnaswamy S, Krishnan UM, Sethuraman S and Sekar RK: Bhanupaka: A Green Process in the Preparation of an Indian Ayurvedic Medicine, Lauha Bhasma. Journal of Chemistry 2013, Article ID 951951.
26. Prakash B: Use of Metal in Ayurvedic Medicine. Indian J of History of science 1997; 32: 1-28.
27. Annamalai AR and Manavalan R: Effect of Trikatu and its individual components and piperine on gastrointestinal tracts. IndianDrugs1990; 27: 595–604.
28. Shirwaikar A, Shirwaikar A, Prabhu SL and Kumar GA: Herbal Excipients in Novel Drug Delivery System. Indian J Pharm Sci 2008; 70: 415-22.
29. Satturwar PM, Fulzele SV and Dorle AK: Biodegradation and in vivo biocompatibility of rosin: A natural film-forming polymer. AAPS Pharm Sci Tech 2003; 4: 1-6.
30. Kumar T, Gupta S K, Prajapati M K, Tripathi D K, Sharma V and Jai P: Natural Excipients: A Review. Asian Journal of Pharmacy and Life Science. 2012; 2:97.
31. Sharangdhar: Sharangdhar Samhita, Brahmanand Tripathi, Choukhambha Surbharati Prakasan, ed.2010, Madhyamkhand 1/6.
32. Singh N and Chaudhary A: A comparative review study of Sneha Kalpana (Paka) vis-a-vis liposome. AYU 2011; 32: 103 - 08.
33. Chaudhary A, Singh N, Dalvi M and Wele A: Progressive review of Sandhana kalpana (biomedical fermentation): an advanced innovative dosage form of Ayurveda. AYU 2011; 32: 408–17.
34. Venkatarajua M P, Gowdaa D V, Rajeshb K S and Shivakumara H G:Xanthan and locust bean gum (from Ceratoniasiliqua) matrix tablets for oral controlled delivery of propranolol hydrochloride. Asian Journal of Pharmaceutical Sciences 2007; 2: 239-48.
35. Drabu S, Khatri S, Babu S and Lohani P: Use of Herbal Bioenhancers to Increase the Bioavailability of Drugs. RJPBCS 2011; 2: 111.
36. Principle of Drug Action: [Access on 15/09/2015]. Available from: http://www.ccras.nic.in/ayurveda/ Chapter-4%20 Drugs. pdf.
37. Moribe K, Limwikrant W, Higashi K and Yamamoto K: Drug Nanoparticle Formulation Using Ascorbic Acid Derivatives. Journal of Drug Delivery Volume 2011; Article ID 138929: 1-9.
38. Reddy K, Mohan G K, Satla S and Gaikwad SL: Natural polysaccharides: versatile excipients for controlled drug delivery systems**.** Asian Journal of Pharmaceutical Sciences 2011; 6: 275 - 86.
39. Baldrick P: Pharmaceutical excipient development: the need for clinical guidance. Regul Toxicol Pharmacol 2000; 32: 210.
40. Sabne PS, Avalaskar AN, jadhav R and Sainkar PS: Natural Excipient. RJPBCS 2013; 2:1347.
41. Pifferi G and Restani P: The safety of pharmaceutical excipients. IL Farmaco 2003; 58: 541-50.
42. Malik V: Law relating to Drugs and cosmetics. Estern Book Company publication Lucknow, 22nd edition, 2010: 230-231.
43. Deogade UM, Deshmukh VN and Sakarkar DM: Natural gum and mucilage in NDDS: Application and recent approaches. Int J Pharm Tech Res 2012; 4: 799-814.
44. Patil BS, Soodam SR, Kulkarni U and Korwar PG: Evaluation of Moringaoleifera as a binder in tablet formulation. IJRAP 2010; 1:590-96.
45. Atal CK, Dubey RK and Singh J: Biochemical basis of enhanced drug bioavailability by piperine: evidence that piperine is a potent inhibitor of drug metabolism. J PharmacolExpTher 1985; 232: 258-62.
46. Drabu S, Khatri S, Babu S andLohani P: Use of Herbal Bioenhancers to increase the Bioavailability of Drugs. RJPBCS 2011; 2: 107.
47. Patil B S, Rao K D, Kulkarni U, Khalid M S and Korwar P G: Properties of *Zingiber officinale* starch as a novel tablet binder. Int J PhSci2010; 2:719.
48. Karan R S, Bhargava V K and Garg S K: Effect of Trikatu on the pharmacokinetic profile of indomethacin in rabbit. Indian J Pharmacol1999; 31: 160-61.
49. Sabne PS, Avalaskar AN, Jadhav R and Sainkar PS: Natural Excipient. RJPBCS 2013; 2:1346.
50. Vinson JA, Kharrat H and Andreoli L: Effect of Aloeverapreparion on the human bioavailability of vitamin C and E. Phytomedicine 2005; 12: 760- 65.
51. Verma A et al. A Review on *Coriandrum sativum* (Linn.): An Ayurvedic Medicinal Herb of Happiness. JAPHR 2011; 1: 28-48.
52. Abdellah A, Noordin MI and Ismail WAW: Importance and globalization status of good manufacturing practice(GMP) requirement for pharmaceutical excipients. Saudi Pharmaceutical Journal 2015; 23: 9-13.
53. Kulkarni VS, Butte KD and Rathod SS: Natural Polymer: a comprehensive review. IJRPBS 2012; 3:1596 - 610.
54. Pifferi G and Restani P: The safety of pharmaceutical excipients. IL Farmaco 2003; 58: 543.

55. Geiling EM and Cannon PR: Pathologic effect of elixir of Sulfanamide (diethyl glycol) poisoning. J Am Med Assoc1938; 111: 919- 26.
56. Crowley P and Martini C: Drug - excipient interactions. Pharmaceutical Techn Europe 2001: 26-34.
57. Anonymous: WHO, Review of world Pharmacopoeia. March 2013, Working document QAS /12.512 /Rev.1 p-15.
58. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fortieth report. Geneva: World Health Organization; 2006. WHO Technical Report Series, No. 937.
59. Cetrificate of Analysis, Guide for Pharmaceutical Excipients, IPEC, 2013, p-1.
60. History of IPEC. [Access on 14 Sept. 2015]. Available from: http://www.ipec.org/history.
61. Excipact Standard. [Access on 15 Sept. 2015]. Available from: http://www.excipact.org/assets/Excipact-Standards .pdf.
62. EXCIPACT GMP and GDP Standards. Available from: (http://www.excipact.org/assets/Excipact-Standards.pdf)
63. NSF/IPEC/ANSI 363-2014 GMP Standard. [Access on 14/09/2015]. Available from: (http://standards.nsf.org/ apps/ group_ public/download.php/26765/NSF%20363-14%20%20 watermarked.pdf.
64. The Joint IPEC-PQG Good Manufacturing Practices Guide for Pharmaceutical Excipient. 2006: IPEC and PQG jointly.
65. Guidance Document (Import &Regulation), doc no. IMP/REG/200711, CDSCO – DGHS, Ministry of Health and Family Welfare, GoI.
66. Malik V: 22nd edition. Law relating to Drugs and cosmetics. Lucknow: Estern Book Company publication; 2010. Rule 169, P-230.
67. Excipients Market - Global Industry Analysis, Market Size, Share, Trends, Analysis, Growth and Forecast, 2012 – 2018. [Access on 12/10/2015]. Available from: http://www. transparencymarketresearch.com/excipientsmarket.html.
68. [Access on 13/10/2015]. Available from: http://www. Prnews wire. com/news releases/ pharmaceutical excipients market worth 84390millionby 2019513279181. html.

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