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(Research Article)

Binding Agents from Cassia Species

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ABSTRACT

The present paper describes novel excipients from Cassia species for their use as binding agents in pharmaceutical formulations. Experiment revealed it to be a slow release pharmaceutical excipient of an inert diluent and a hydrodrophilic material including xanthan gum and galactomannan gums capable of cross-linking the xanthan gum in the presence of aqueous solutions that are parallely utilized for quick release tablet formulation. This paper waves off the difficulty of pharmacist who earlier used to face unacceptable flow characteristics and compressibility factors of the crystalline or powdered medicament. It possess flow ability, sufficient particle size distribution, binding ability, acceptable bulk and tap densities, and acceptable dissolution and disintegration properties in order to release the medicament upon oral administration.

Keywords: Pharmaceutical excipients, Hydrodrophilic material, Xanthan gum, *Cassia grandis*, *Cassia angustifolia*, Guar, *Cassia tora*, Xanthan, Carboxymethyl gum.

INTRODUCTION

Cassia, the fourth largest legume genus, comprises approximately 600 species, most of them are native to tropical and subtropical regions. The endosperm of the seeds of this leguminosae species constitute a rich source of galactomannan gums[1] which like the famous guar gum can be utilized in pharmaceutical industry[2]. They are GRAS (Generally Regarded as Safe).

Cassia tora (originally described by Linné as *Cassia tora*) is a legume in the subfamily *Caesalpinioideae*. In Sri Lanka it is easily found in many places[3]. It grows wild in most of the tropics and is considered a weed in many places; its native range is not well known but probably South Asia. According to Ayurveda, the leaves and seeds are acrid, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardiotonic and expectorant. The leaves and seeds are useful in leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders.

Cassia angustifolia popularly known as Senna is a shrub which is found in plenty in South India[4]. Its leaves contain glycosides, sennoside A, sennoside B, sennoside C and sennoside D. Two naphthalene glycosides have been isolated from leaves and pods. It also contains the yellow flavonol colouring matter kaempferol, its glucoside kaempferin and isorhamnetin. It cleanses and purifies the blood and causes a fresh and lively habit of the body. It is used in constipation, abdominal disorders, leprosy, skin diseases, leucoderma, splenomegaly, hepatopathy, jaundice, helminthiasis, dyspepsia, cough, bronchitis, typhoid fever, anaemia and tumours[5-8].

Cassia grandis popularly known as Pink Shower is a tropical tree in which the fruits are found throughout the year[9,10]. It is used in the preparation of health drinks and due to its rich iron content, it is used for anemia. The juice of roots and leaves have antiseptic properties. Chemical constituents comprise of anthraquinone, steroid, alkaloid, protein, carbohydrates etc. The present paper describes novel excipients from Cassia species for their use as binding agents in pharmaceutical formulations.

MATERIAL AND METHODS

The plant material were collected from Pratap seed nursery, Dehradoon and was authenticated by Taxonomist of Amity University Uttar Pradesh (Noida).

Extraction and Carboxymethylation of the Gum

The seeds from guar and *Cassia* were manually cleaned to remove external materials like straw, dust and soil. The damaged and prematured seeds were separated out. The middle endosperm portion of seeds was separated from germ (inner part) by following procedure:

(a) Dry milling : The weighed amount of seeds were repeatedly roasted in microwave oven for 2 min with regular interval of 30 seconds. The roasted seeds were then grinded in grinder/mixer for breaking the seeds into two halves followed by separation of endosperm from rest of the material using soup and various sieves. Repeated this procedure several times till pure endosperm portion was obtained.

(*b)Wet milling :* Soaked the seeds in 50 % of alcohol for few hours and swollen seeds were subjected to the endosperm by the above procedure.

(c) Crushing of endosperm: Crush Endosperm to fine powder by grinding and hammer mill. Powders were obtained of varying mesh sizes ranging from 100-200 mesh Crude gum of 100, 150 and 200 mesh sizes were obtained and kept in vacuum dessicator.

5 gms of the crude endosperm powder extracted from the endopsperm part of the seed was taken with enough water to prepare a slurry and was further subjected to stirring for 25^{o}C for half an hour. 35.8ml iso-propanol was added following addition of 30% aqueous sodium hydroxide. The treated slurry was now kept in oven maintained at 45^{0}C for 15 minutes. The slurry was again taken out and treated with 3 gm of Chloroacetic acid and stirred vigorously at 25 ^{0}C for half an hour. The treated slurry was now kept in oven maintained at 45^{0}C for 15 minutes. The above mixture was subjected to react with 3 gms of Chloroacetic acid at 25 ^{0}C for 15 minutes Finally this slurry was kept in oven for 3 hrs maintained at 55 ^{0}C for 3 hrs. After completion of the reaction, this above compound was subjected to Vacuum Filtration. The residue was taken in 25 ml of 70% methanol, stirred, neutralized with 90 % glacial acetic acid. It was finally filtered, washed with 70 % followed by 100 % methanol[11,12].

RESULTS AND DISCUSSION

Table-1 shows the comparison between latest innovation and closest known art. Table-2 shows the amount/ proportion/percentage of used compositions for formulation; proportion and percentage for all these compositions and also the binding property comparison with other binding agents.

Table 1: Comparison between latest invention and closest work done

S. No.	Step	Present Innovation	Previous Innovations	Remark
1.	Excipients	Novel Binding agents	Mainly guar and other cassia species also few exudate gums have been used	Grandis and angustifolia gum along with Xanthan have not been reported and are providing better results
2	Pre- Quality Control Parameters	Good, better than guar	Mostly guar and *Cassia tora* seed gums have been utilized	The results are much better and are commercially compatible
3	Quality Control Parameters	Grandis and Angustifolia gums have shown better results in reference to disintegration and dissolution time	Commercially used guar and carboxymethylated guar resulted in a good sustained released tablet matrix	The matrix for sustained release and direct compression tablets provided by these gums were nearly equivalent and far more better than the previously used ones
4	Overall Formulation	Novel binding agents introduced for commercial application and these due to value addition refrain themselves from any contamination	Commercially applicable but needs improvement	A novel and alternative source of Hydrocolloid to be used as an binder for Tablet formulation has been introduced

Table 2: Binding property comparison with other binding agents

	Weight of tablets				Hardness (Kg/in^2)			
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
G:X+E								
1:5:294	2	0.2927±0.0045	1.53	11.2	2.11±0.0727	14.22	0.81	3min 29sec
8:4:288	4	0.2960±0.0022	0.43	3.45	3.98±0.0686	11.47	0.74	5 min 40 sec
8:7:285	5	0.2946±0.0152	5.15	5.85	2.64±0.2300	4.96	0.79	4 min 20 sec
20:10:270	10	0.2983±0.0011	0.36	4.04	5.40±0.4700	12.34	0.64	10min 1sec
CMG:X+E								
4:2:294	2	0.2958±0.0059	1.99	12.50	8.54±0.5300	13.5	0.21	95 min 36 sec
2:10:288	4	0.2968±0.0022	0.74	6.45	9.89±0.1300	12.6	0.15	110 min 40 sec
9:6:285	5	0.2977±0.0043	1.44	12.03	11.54±0.5918	13.70	0.14	180 min 25 sec
25:5:270	10	0.2975±0.0016	0.53	5.23	13.52±0.7568	16.74	0.10	220 min 15 sec
G+E								
6: 294	2	0.2954±0.0054	1.54	11.50	2.54±0.6300	13.50	0.56	5 min 45 sec
12:288	4	0.2989±0.0042	1.35	10.50	3.65±0.5600	12.60	0.48	9 min 65 sec
15:285	5	0.2986±0.0045	1.44	12.03	3.32±0.4936	11.70	0.36	7 min 40 sec
30:270	10	0.2990±0.0022	0.65	5.84	4.45±0.7568	9.74	0.31	12 min 8 sec
X +E								
2:298	2	0.2984±0.0025	0.58	4.64	7.56±0.5400	12.35	0.65	40 min 20sec
10:290	4	0.2987±0.0035	0.64	5.88	7.40±0.5145	11.00	0.36	55 min 40 sec
13:287	5	0.2985±0.0045	1.24	10.26	7.22±0.4415	5.00	0.54	63 min 12 sec
28:272	10	0.2978±0.0045	1.33	9.85	8.84±0.3240	12.00	0.44	80 min 30 sec
An:X+E								
5:1:294	2	0.2984±0.0025	0.51	4.36	4.84±0.6503	5.64	0.23	9 min 10 sec
1:9:288	4	0.2974±0.0022	0.62	4.35	4.56±0.4343	8.54	0.15	8 min 20 sec
6:9:285	5	0.2990±0.0016	0.32	2.31	4.32±0.3468	10.56	0.36	14 min 65 sec
20:10:270	10	0.2988±0.0015	0.25	2.25	6.48±0.2345	6.54	0.48	20 min 20 sec

CMAn:X+E								
3:3:294	2	0.2989±0.0021	0.45	3.96	6.87±0.5100	12.25	0.32	45 min 20 sec
0.5:10:288	4	0.2959±0.0015	0.28	2.25	7.00±0.4300	11.56	0.56	60 min 90 sec
9:6:285	5	0.2968±0.0012	0.21	1.95	8.32±0.2424	10.70	0.69	105 min 76 sec
25:5:270	10	0.2985±0.0013	0.23	2.15	9.52±0.2365	9.74	0.54	125 min 45 sec
An+E								
8:294	2	0.2978±0.0056	1.75	13.06	4.54±0.4230	6.10	0.42	13 min 36 sec
15:285	4	0.2995±0.0045	1.36	10.55	5.40±0.4526	12.50	0.35	23 min 68 sec
18:292	5	0.2963±0.0024	0.72	4.85	4.00±0.3618	13.45	0.97	15 min 54 sec
34:278	10	0.2994±0.0021	0.68	4.52	4.84±0.5642	16.00	1.23	18 min 15 sec
Gu+E								
5:295	2	0.2969±0.0024	0.65	4.23	3.40±0.3564	13.25	0.33	15 min 20 sec
1:299	4	0.2957±0.0020	0.59	4.00	4.25±0.5464	12.45	1.65	20 min 20 sec
12:288	5	0.2967±0.0018	0.56	4.15	4.32±0.4323	13.45	0.56	36 min 28 sec
20:280	10	0.2987±0.0015	0.46	3.85	5.12±0.2365	12.30	0.54	48 min 40 sec
T+E								
4:298	2	0.2957±0.0016	0.39	3.25	4.54±0.3156	12.5	0.32	35 min 50 sec
10:290	4	0.2997±0.0005	0.10	2.00	5.40±0.4001	14.1	0.65	45 min 40 sec
13:287	5	0.2983±0.0026	0.72	5.15	5.45±0.4623	13.70	0.34	55 min 60 sec
28:272	10	0.2968±0.0032	1.09	8.16	5.65±0.2565	11.45	0.56	57 min 40 sec
Gu:X+E								
3:3: 294	2	0.2965±0.0015	0.29	3.15	5.60±0.4514	11.5	0.25	50 min 32 sec
7:5:288	4	0.2977±0.0025	0.95	6.12	5.85±0.5600	10.26	0.36	65 min 46 sec
8:7:285	5	0.2989±0.0035	1.25	7.05	7.32±0.4128	11.32	0.24	80 min 30 sec
12:18:270	10	0.2993±0.0043	1.55	10.65	8.52±0.2641	12.36	0.45	100 min 40 sec
CMGu:X+E								
1:5:294	2	0.2998±0.0045	1.65	11.23	8.40±0.2113	12.5	0.21	90 min 60 sec
3:9:288	4	0.2956±0.0023	0.64	6.36	9.40±0.2536	11.3	0.15	110 min 40 sec
1:14:285	5	0.2978±0.0033	0.85	8.41	10.32±0.3412	12.4	0.14	160 min 10 sec
1O:20:270	10	0.2984±0.0043	0.98	10.34	12.52±0.4346	14.5	0.10	200 min 05 sec
T:X+E								
4:2:294	2	0.2985±0.0022	0.54	7.35	5.85±0.2626	10.32	0.20	60 min 10 sec
8:4:288	4	0.2989±0.0026	0.78	9.35	6.58±0.3430	10.56	0.18	80 min 25 sec
6:9:285	5	0.2979±0.0015	0.29	3.12	8.25±0.4658	12.56	0.25	115 min 11 sec
15:15:270	10	0.2975±0.0012	0.33	2.64	9.15±0.6568	15.85	0.24	140 min 20 sec
CMT:X+E								
2:4:294	2	0.2976±0.0044	1.56	10.89	6.15±0.2431	11.32	0.32	70 min 20 sec
6:6:288	4	0.2978±0.0037	1.33	9.88	8.35±0.2326	14.65	0.13	118 min 35 sec
8:7:285	5	0.2956±0.0026	0.74	9.15	10.20±0.5004	15.15	0.15	150 min 10 sec
25:5:270	10	0.2988±0.0041	1.26	9.55	13.45±0.4697	15.96	0.14	180 min 24 sec

G: Grandis gum; **X**: Xanthan gum**; CMG**: Carboxymethylgrandis; **An**: Angustifolia gum; **CMAn**: Carboxymethylangustifolia ; **Gu**: Guar; **T**: Tora gum; **CMGu**: Carboxymethylguar; **CMT**: Carboxymethyltora; **E**: Excipients and drug {Drug: 50 mg; Mg stearate (Lubricant): 6mg; Lactose (diluent): 220mg)
A: Composition, **B**: Concentration of Binders % (w/v), **C**: Mean± S.D. of 100 tablets,
D: c.v. % **E**: % Fines **F**: Mean± S.D. of 100 tablets **G**: c.v. % **H**: % Friability, **I**: Disintegration time (Mean of 100 tablets)

CONCLUSION

The results indicated that carboxymethylated and native gums from *Cassia grandis* and *Cassia angustifolia* along with xanthan give results within the Quality Control Parameters (QQP's) required for assessing a binding agents. Author concludes that these gums can easily replace the existing guar and *Cassia tora* gums.

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