

Investigation of Hydrogel Isolated from Seeds of *Ocimum basilicum* as Binder

A. V. BHOSALE*, S. HARDIKAR, A. A. PATHAK AND R. V. SABLE

Poona District Education Association's Seth Govind Raghunath Sable College of Pharmacy, Saswad, Pune-412 301, India

Bhosale, *et al.*: Hydrogel Isolated from Seeds of *Ocimum basilicum* as Binder

Ayurvedic powders are widely used as therapeutic agents but most of them have unpleasant taste and large doses. One of the possible approach to overcome these drawbacks is to represent them in unit dosage form i.e. tablet dosage form. The purpose of this study is to elucidate and quantify the compressibility and compactibility of herbal granules prepared by using hydrogel isolated from whole seeds of *Ocimum basilicum* as a novel binder. The compressibility is the ability of the powder to deform under pressure and the compactibility is the ability of a powder to form coherent compacts. To test the functionality of novel excipients, Sonnergaard proved a simple linear model to confirm compactibility, which is an uncomplicated tool for quantification. The tablets were compressed at increasing compression pressures and were evaluated for various mechanical properties. The linear relationship between specific crushing strength and compression pressure revealed the compactibility of the herbal granules and the linear relationship between porosity and logarithm of compression pressure revealed the compressible nature of the herbal granules according to the model developed by Sonnergaard. Thus the hydrogel isolated from whole seeds of *Ocimum basilicum* had potential as a granulating and binding agent.

Key words: *Ocimum basilicum*, compressibility and compactibility, novel binder, hydrogel

In the traditional system of medicines e.g. Ayurveda, many of the remedies are in the form of powders. The dose of these powders is very large, many of them are difficult to swallow or give poor bioavailability owing to their poor wetting and many have pungent or unacceptable taste. It is proposed in Ayurveda that ideally dosage form should be pleasantly tasted and in a compact form^[1]. One of the possible approaches to overcome these drawbacks of Ayurvedic powders is to present them in the form of a unit dosage form i.e. tablet. *Triphala* powder is widely used as anti diabetic and for eyesight improvement^[2] in Indian population and has poor

compressibility index (40%). Hence *Triphala* powder was selected as a model for investigation of binding and granulating properties of hydrogel isolated from whole seeds of *Ocimum basilicum*. Compressibility can be imparted by preparing granules following wet granulation technology and by using suitable granulating and binding agent^[3]. In an attempt to avoid complexities associated with development of synthetic and semi synthetic excipients, an unexplored area of herbal products was tried. The whole seeds of *Ocimum basilicum* were authenticated by Agharkar Research Institute, Pune. The hydrogel^[4] was isolated from whole seeds and used as a binding and granulating agent to prepare granules of *Triphala* powder. The seeds were soaked in demineralised water in a proportion 1:20 for 2 hrs. Then the whole mass

*Address for correspondence

E-mail: srhsgs@yahoo.co.in

was diluted with demineralised water, homogenised and centrifuged to isolate hydrogel from seeds.

Hydrogel was characterised for appearance, specific gravity and viscosity. Hydrogel was white, translucent and viscous liquid with specific gravity 1.013^[5]. Viscosity of hydrogel was measured by using Brookfield viscometer (Model- DV II +) with spindle number 61. Viscosity of liquid decreased with increasing rate of shear. Thus hydrogel was shear thinning system. The results are reported in Table 1. It was also scanned for UV absorption. It absorbs UV radiation at 296 nm. This can be used as identification and quantification test of hydrogel as it obeys Beers Lamberts Law in the range 2 ppm to 16 ppm (fig. 1). About 25 g of seeds yielded 1.1 l of hydrogel of specifications reported in Table 1.

Hydrogel is liable to exhibit microbial contamination and stock solutions therefore should be preserved

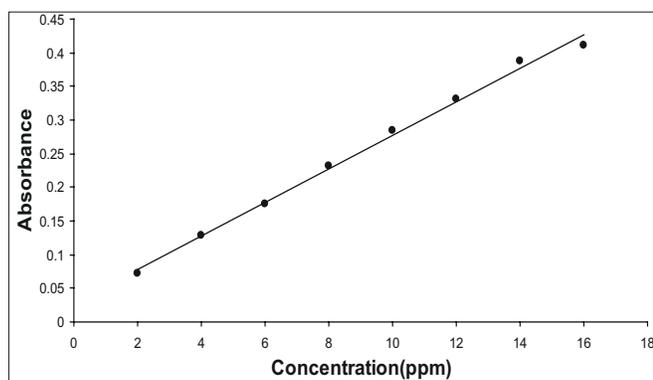


Fig. 1: Calibration curve for hydrogel in the range 2 to 16 ppm. The equation of the line obtained was $y = 0.0249x + 0.0288$ with r^2 value of 0.9951.

TABLE 1: RESULTS OF MEASUREMENT OF VISCOSITY OF HYDROGEL

Speed of a spindle* (rpm)	% Torque	Viscosity (cp)
30	8.1	16.3
50	11.6	14
60	13.1	13.1
100	21.5	12.8

Cp is viscosity of hydrogel in centipoises. *Spindle number 61 was used for viscosity measurement.

TABLE 2: RESULTS OF MECHANICAL STRENGTH PARAMETERS OF TABLETS AT VARIOUS COMPRESSION PRESSURES

Compression Pressure (P, Tonnes)	Diameter* (d, cm)	Height* (h, cm±SD)	Weight* (W, g±SD)	Porosity (ε)	Hardness* (F, kg/cm ² ±SD)	Specific crushing strength (SCS)
1	0.8	0.50±0.03	0.305±0.02	0.241	1.2±0.09	2.98
2	0.8	0.44±0.45	0.290±0.01	0.183	1.9±0.56	5.35
3	0.8	0.42±0.44	0.290±0.01	0.151	3.2±0.07	9.35
4	0.8	0.41±0.01	0.284±0.02	0.124	3.9±0.15	12.02
5	0.8	0.40±0.02	0.286±0.01	0.107	4.7±0.16	14.65

*All values indicate mean±SD (n=10)

with a combination of methyl paraben and propyl paraben. It is most stable at pH 5 to 7. The bulk stock of hydrogel should be stored in airtight glass container and at cool place. Granules of *Triphala* powder were prepared by wet granulation technology adding sufficient quantity of hydrogel as binding and granulating agent^[3]. The quantity of hydrogel of given specifications required was 3 gm to prepare the granules of 10 g *Triphala* powder. The granules were evaluated for particle size distribution, moisture content and flow properties^[6,7]. Particle size distribution of granules was between 0.99 to 1.3 μ. Moisture content of granules was 0.07%, Hausner ratio was 0.149 and compressibility index was 13%. These results revealed that granules possessed necessary compression characteristics and they were suitable for tableting. The granules were compressed on a mini rotary tablet press (Mini press II MT) with 8 mm diameter, circular and flat punches. Tablets were prepared at five different compression pressures (P) viz. 1, 2, 3, 4 and 5 Tons.

Thickness (h), weight (w) and diameter (d) of intact, ejected tablets were measured. Results are reported in Table 2 and are the means of ten measurements. The porosity of a tablet was calculated from tablet dimensions, weight of the tablet and particle density according to the Eqn. 1^[8], $\epsilon = 1 - w / \pi d^2 h \rho - 1$, where, ϵ is the porosity of a tablet, w is the weight of the tablet, d the diameter of the tablet, h the height of the tablet and ρ is the true density of the granules. The mechanical properties of tablets were determined^[9,10]. Hardness or crushing strength for ten tablets was measured by tablet strength tester (Pfizer hardness tester). Results are reported in Table 2. Specific tensile strength (SCP) was calculated according to Eqn. 2^[9], $SCP = F / dh - 2$, where, F is the crushing strength or hardness of a tablet, d is the diameter of the tablet and h is the height of the tablet. The compaction properties of pharmaceutical materials are compressibility and compactibility. Compressibility is the ability of the powder to deform under pressure

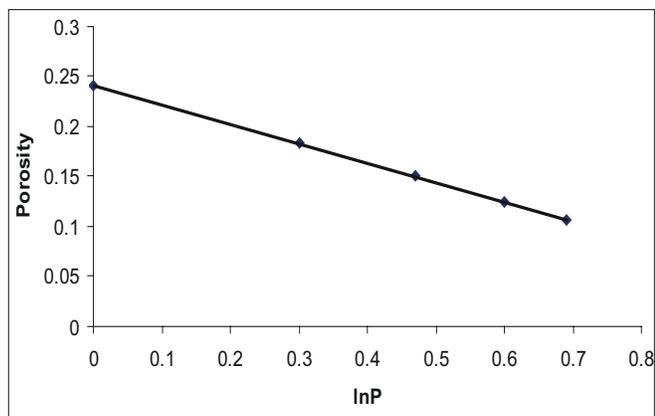


Fig. 2: Linear relationship between porosity of tablets and log compression pressure.

Compressibility of granules was confirmed by linear relationship between porosity of tablets and logarithm of compression pressure. The equation obtained was $y = -0.1944x + 0.2413$ with r^2 value of 0.9998.

and the compactibility is the ability of the powder to form coherent compacts. According to Zhao *et al.*^[11] a simple relationship between $\ln P$ and porosity indicates compressibility of material (Eqn. 3). $\epsilon = -C \cdot \ln P + d - 3$.

In fig. 2, porosity of a tablet was plotted against logarithm of compression pressure. A linear relationship was observed. This indicated the compressible nature of granules. The compactibility is more relevant and interesting from practical point of view. With the growing interest in the functionality of excipients there was a need for simple and standardised measure of compactibility. Sonnergaard^[9] established a simple linear model for compactibility. He calculated specific crushing strength (SCS) and showed that the slope of the regression line $SCP = C_p \cdot P + b$ represents dimensionless compactibility parameter^[9-10]. In fig. 3 specific crushing strength was plotted against compression pressure. A straight line was obtained which revealed the compactibility of granules. Since above relations are linear, the *Triphala* granules had optimum compressibility and compactibility when prepared by using hydrogel obtained from whole seeds of *Ocimum basilicum* as a novel binding and granulating agent.

ACKNOWLEDGEMENTS

The authors are thankful to University of Pune for providing financial support.

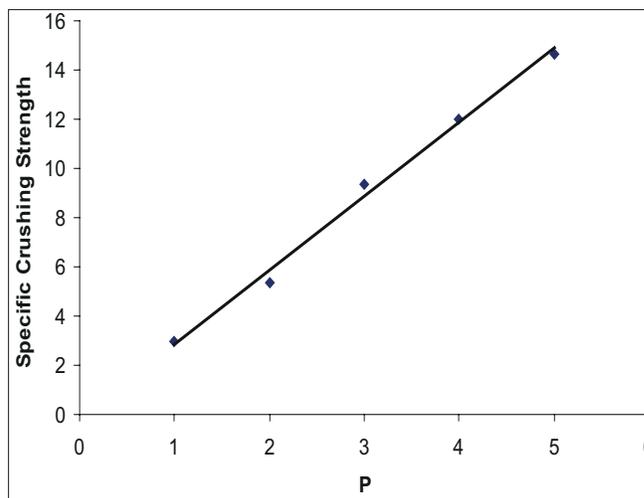


Fig. 3: Linear relationship between specific crushing strength of tablets and compression pressure.

Compactibility of granules was confirmed by linear relationship between specific crushing strength of tablets and compression pressure. The equation obtained was $y = 3.001x - 0.133$ with r^2 value of 0.9936.

REFERENCES

- Siddhi Stan In: Charak S, Pande GS, editor. Bhavprakash Nighantu. Varanasi: Chaukhamba Bharati Academy; 2006. p. 12.
- Bandelin FJ. Compressed tablets by wet granulation. In Lieberman HA, Lachman L, Schwartz JB, editors. Pharmaceutical dosage forms: Tablets. Vol. 1. 2nd ed. New York: Marcel Dekkar; 1996. p. 131-90.
- O'Neil CK, Fetrow CW. Plants as drugs. In: Brick JS, Boylan JC, editors. Encyclopaedia of Pharmaceutical Technology Vol. 3. 2nd ed. New York: Marcel Dekkar; 2002. p. 2214-25.
- Pharmacopoeia of India, 4th ed. Vol. 2, New Delhi: Controller of Publication; 1996. p. A-99.
- Kottake MK, Rudnic EM. Tablet dosage forms. In: Bankar GS, Rhodes CT, editors. Modern Pharmaceutics. 4th ed. New York: Marcel Dekkar; 2002. p. 287-333.
- European Pharmacopoeia, Supplement 5.3, 5th ed. Directorate for the Quality of Medicine of the Council of Europe (EDQM); 2005. p. 3363-6.
- Armstrong NA. Tablet manufacture. In: Brick JS, Boylan JC, editors. Encyclopaedia of Pharmaceutical Technology. Vol. 3. 2nd ed. New York: Marcel Dekkar; 2002. p. 2713-31.
- Sonnergaard JM. Quantification of the compactibility of pharmaceutical powders. *Eur J Pharm Biopham* 2006;63:270-7.
- Alderborn G. Tablets and Compaction. In: Aulton ME, editor. *Pharmaceutics: The science of Dosage form design*. 2nd ed. Churchill Livingstone; 2001. p. 397-440.
- Zhao J, Burt HM, Miller RA. The Gurnham equation in characterizing the compressibility of pharmaceutical materials. *Int J Pharm* 2006;317:109-13.

Accepted 14 June 2009

Revised 13 February 2009

Received 16 August 2007

Indian J. Pharm. Sci., 2009, 71 (3): 320-322