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Developing stable multiparticulate colonic drug delivery dosage

Vinayak K and Dr. Anuj Kumar Sharma

Abstract
Some of the many benefits of multiparticulate systems are that they make drugs more bioavailable and lower the risk of local discomfort and general poisoning. A number of different particle types are used, including pellets, microparticles, grains, and nanoparticles. More often than not, multiparticulate systems are better than single unit dose types because they can get into the gut faster and stay there for longer.

Keywords: Medications, effectively, orally, benefits

Introduction
It is easy for these devices to move through the GIT because they are small. Using multiparticulate systems, which are spread out more evenly in the digestive track, can help medications be absorbed better. Instead of releasing the medication into the small intestine and stomach, a good route for delivering drugs to the colon delivers it into the colonic area. The efficacy of colon-targeted medication delivery is assessed using a Several *in vitro* and *in vivo* method.

One of the main issues for evaluating the rectal drug delivery method *in vitro* is working on a good way to test for breakdown. There are many non-traditional ways that have been written about to test how well a colon focused delivery system works in a controlled laboratory setting. The dissolving testing of colon delivery devices is done to mimic the pH and passage time of the digestive tract in real life was conducted using the conventional basket technique in various pH buffers for varied durations. The study by Yang L.*et al*. goes into length about many approaches for colon-targeted medication delivery system *in vitro* testing.

The 13th edition of the Japanese Pharmacopoeia also includes a report on a dissolution study using the paddle approach for colon focused medication administration. Both fluids, with pH levels of 1.2 and 6.8, were described as suitable for dissolving purposes. You can also make the dissolving test look like it would happen in the gut by using continuous-flow tools in a pH development medium at 370c. For enteric-coated pellets with variable pH levels, Jean Paul Ramón described the use of a reciprocating cylinder technique (Type 3 USP apparatus) 16. The equipment has also been used in conjunction with sequential dissolving liquid, which consists of simulated stomach fluid for 60 minutes and then 3-6 hours of simulated intestinal fluid. In contrast to type II equipment, apparatus III (the reciprocating cylinder) was shown by Jinhe Li *et al*. to be both appropriate and competent. The USP XXIII dissolving apparatus was shown by Akhgari A. and Sadoghi F. in fluids with pH 1.2 and 0.1 N HCl, as well as pH 6.5, 6.8, and 6.7, over time and with changes in pH. and 7.2 with phosphate buffer, replicating conditions in the gastrointestinal system.

Literature review
V.R. Sinha *et al*. (2022) [1], Core tablets containing Indomethacin and binders such as polysaccharides xanthan gum, guar gum, chitosan, or synthetic polymers such as Eudragit E Apparently, Eudragit-L 100 was covered on the inside of their bodies. Instead of guar gum, chitosan showed potential as a colon-targeting binding in the study.

C.W. Leong *et al*. (2022) [2], A commercial aqueous ethylcellulose dispersion (Surelease) was investigated for its film-forming capabilities by in conjunction with various amounts of a plasticizer and varying amylose/butanol complex ratios. They proved that amylose could target the colon and that the amount of deterioration of the film was proportional to its amylose level.

In a time-controlled method, L. G. Maria *et al*. (2023) created a diclofenac sodium matrix tablet with varying ratios of sodium chloride and Eudragit. If they changed the percentage, they found that a zero-order releasing profile could be used to target the colon.

V.R. Sinha *et al*. (2023) [4]. This review study provided a comprehensive overview of the bacterial approach to colon targeting, focusing on the microbial count and function of the colon. They went into more detail on the list of bacterially sensitive polymers for drug release in the colon, which included amylose and ethyl cellulse.

For colon-specific medication delivery, C. I. Valentine *et al*. (2014) [5] compared Eudragit FS 30D to Eudragit S100 and found that the former had a better regulated rate of dissolution. When compared to Eudragit S10087, *In vivo* scintigraphy using a mixture covered with Eudragit FS 30 D showed better results for drug release in the colon of people.

Evaluation for Multiparticulate

Micromeritic studies

Investigations on the microstructure of pilot batches of multiparticulate: Ciprofloxacin, ketoprofen, and 5-fluorouracil had an average particle size ranging from 1mm to 1.5mm throughout the different trial batches. Mixing different kinds of polymers in a formula changes the size of the multiparticulate particles. Size range for multiparticulate depends on content and molecular weight and viscosity of chitosan. Multiparticulate size is reduced when chitosan concentration is reduced. Ciprofloxacin and ketoprofen trial batches had tapped density values ranging from 0.49 to 0.55 g/cm^3, while the tapped densities of the 5-fluorouracil test batches were between 0.6 and 0.7 g/cm^3. For test runs of Ciprofloxacin and Ketoprofen, the bulk density was determined to be 0.48-0.54 g/cm^3, whereas for 5-fluorouracil, it was 0.51-0.62 g/cm^3.

Table 1: Micromeritic studies of trial batches

BatchCode	AverageParticle size(mm)	Bulk density (g/cm^3)	Tapped density (g/cm^3)	Angle ofrepose (°)
C1a	1.1 ± 0.084	0.51 ± 0.02	0.55 ± 0.06	29.74±1.2
C2a	1.1 ± 0.014	0.49 ± 0.06	0.52 ± 0.04	28.54±1.1
C3a	1.3 ± 0.078	0.48 ± 0.03	0.50 ± 0.07	30.21±1.2
C4a	1.5 ± 0.012	0.52 ± 0.02	0.55 ± 0.04	29.84±1.3
C5a	1.4 ± 0.016	0.53 ± 0.04	0.51 ± 0.08	28.71±1.2
C1b	1.2 ± 0.014	0.52 ± 0.06	0.53 ± 0.04	29.74±1.2
C2b	1.4 ± 0.084	0.48 ± 0.04	0.49 ± 0.05	28.76±1.1
C3b	1.2 ± 0.014	0.54 ± 0.04	0.55 ± 0.06	31.21±1.2
C4b	1.2 ± 0.078	0.49 ± 0.02	0.51 ± 0.03	29.74±1.1
C5b	1.5 ± 0.012	0.48 ± 0.04	0.53 ± 0.07	28.54±1.2
K1a	1.4 ± 0.056	0.52 ± 0.07	0.54 ± 0.04	29.74±1.3
K2a	1.5 ± 0.034	0.51 ± 0.04	0.53 ± 0.05	29.82±1.2
K3a	1.5 ± 0.087	0.51±0.02	0.55 ± 0.03	30.21±1.3
K4a	1.5 ± 0.022	0.48 ± 0.03	0.51 ± 0.02	29.74±1.2
K5a	1.5 ± 0.075	0.48 ± 0.06	0.52 ± 0.03	28.34±1.1
K1b	1.5 ± 0.013	0.49 ± 0.01	0.50 ± 0.07	29.76±1.2
K2b	1.4 ± 0.054	0.52 ± 0.09	0.53 ± 0.06	30.21±1.2
K3b	1.5 ± 0.012	0.53 ± 0.04	0.52 ± 0.04	29.69±1.2
K4b	1.1 ± 0.064	0.49 ± 0.04	0.51 ± 0.07	29.74±1.2
K5b	1.1 ± 0.013	0.51 ± 0.06	0.53 ± 0.03	28.47±1.3
5FU1a	1.3 ± 0.078	0.6 ± 0.06	0.60 ± 0.07	29.74±1.2
5FU2a	1.5 ± 0.012	0.53 ± 0.03	0.65 ± 0.02	30.21±1.2
5FU3a	1.4 ± 0.056	0.55 ± 0.02	0.58 ± 0.04	29.64±1.2
5FU4a	1.5 ± 0.014	0.51 ± 0.04	0.60 ± 0.03	28.47±1.2
5FU5a	1.1 ± 0.081	0.53 ± 0.03	0.63 ± 0.06	29.74±1.1
5FU1b	1.5 ± 0.014	0.53 ± 0.05	0.58 ± 0.02	30.21±1.2
5FU2b	1.3 ± 0.078	0.62 ± 0.02	0.70 ± 0.04	29.64±1.3
5FU3b	1.5 ± 0.012	0.55 ± 0.04	0.64 ± 0.08	29.74±1.2
5FU4b	1.3 ± 0.056	0.61 ± 0.04	0.71 ± 0.05	29.64±1.1
5FU5b	1.5 ± 0.012	0.51 ± 0.03	0.59 ± 0.04	28.68±1.2

* We performed triple analyses on each sample. (n = 3)

C=Ciprofloxacin, K=Ketoprofen and 5FU=5-Fluorouracil, Coat Composition a=10%, b=15%

Micromeritic studies of factorial batches of multiparticulate

The size of the particles on average in the factorial batches ranged from 1mm to 1.6mm, and for Ciprofloxacin, Ketoprofen, and 5-fluorouracil, the tapped density was between 0.50-0.55 g/cm^3. The bulk densities of all the random batches were between 0.48 and 0.62 g/cm^3. The flow properties of all formulations were satisfactory, with angle of repose values ranging from 250 to 350, an acceptable range for multiparticulate materials.

Table 2: Micromeritic studies of factorial batches of Ciprofloxacin

Parameters Batches	Average particle size(mm)	Bulk density (g/cm^3)	Tapped density (g/cm^3)	Angle ofrepose (°)
C1	1.2 ± 0.054	0.50 ± 0.05	0.53±0.05	31.24±1.2
C2	1.1 ± 0.015	0.50 ± 0.04	0.51±0.03	29.54±1.4
C3	1.3 ± 0.012	0.50 ± 0.03	0.53±0.05	30.21±1.3
C4	1.2 ±0.015	0.52 ± 0.06	0.55±0.06	29.52±1.2
C5	1.5 ± 0.013	0.53 ± 0.04	0.51±0.08	28.51±1.2
C6	1.2 ± 0.014	0.52 ± 0.06	0.53±0.03	29.74±1.2
C7	1.4 ± 0.084	0.49 ± 0.04	0.50±0.08	30.46±1.3
C8	1.2 ± 0.014	0.53 ± 0.04	0.51±0.08	30.41±1.2
C9	1.2 ± 0.078	0.49 ± 0.02	0.51±0.03	32.32±1.1
C10	1.5 ±0.012	0.48 ± 0.04	0.53±0.07	28.54±1.2
C11	1.4 ± 0.056	0.52 ± 0.07	0.54±0.04	29.74±1.4
C12	1.6 ± 0.033	0.50 ± 0.05	0.53±0.05	29.82±1.3
C13	1.5 ± 0.053	0.51 ± 0.02	0.55±0.03	30.21±1.4
C14	1.5 ± 0.022	0.48 ± 0.03	0.51±0.02	29.63±1.2
C15	1.5 ± 0.045	0.50 ± 0.07	0.53±0.06	31.35±1.1
C16	1.5 ± 0.023	0.52 ± 0.01	0.55±0.04	29.56±1.4
C17	1.4 ± 0.054	0.52 ± 0.08	0.53±0.05	30.31±1.3

* We performed triple analyses on each sample. (n = 3)

Table 3: Micromeritic studies of factorial batches of Ketoprofen

Batch Code	Average particle size(µm)	Bulk density(g/cm^3)	Tapped density (g/cm^3)	Angle of repose (°)
K1	1.4±0.051	0.49±0.03	0.50±0.06	31.34±1.3
K 2	1.1±0.016	0.50±0.06	0.52±0.03	29.54±1.1
K 3	1.3±0.051	0.49±0.01	0.50±0.07	30.21±1.2
K 4	1.3±0.015	0.53±0.09	0.54±0.04	30.64±1.2
K 5	1.3±0.014	0.49±0.03	0.52±0.08	30.71±1.4
K 6	1.5±0.011	0.52±0.06	0.53±0.03	31.41±1.2
K 7	1.5±0.024	0.49±0.04	0.53±0.05	30.76±1.2
K 8	1.3±0.015	0.52±0.04	0.55±0.06	31.21±1.3
K 9	1.3±0.068	0.49±0.02	0.51±0.03	29.74±1.2
K 10	1.6±0.015	0.50±0.04	0.53±0.07	31.54±1.3
K 11	1.3±0.055	0.52±0.07	0.54±0.04	30.74±1.2
K 12	1.6±0.032	0.51±0.04	0.53±0.05	29.82±1.4
K 13	1.4±0.065	0.54±0.02	0.55±0.03	30.21±1.2
K 14	1.5±0.023	0.49±0.03	0.51±0.02	29.74±1.2
K 15	1.4±0.045	0.50±0.06	0.52±0.03	31.34±1.3
K 16	1.5 ±0.013	0.49±0.01	0.50±0.07	30.76±1.2
K 17	1.3±0.053	0.52±0.09	0.53±0.06	30.21±1.3

* We performed triple analyses on each sample. (n = 3)

Table 4: Micromeritic studies of factorial batches of 5- Fluorouracil

Batch Code	Average particle size(µm)	Bulk density (g/cm^3)	Tapped density (g/cm^3)	Angle of repose (o)
5FU1	1.4±0.074	0.51±0.04	0.54±0.06	29.74±1.3
5FU 2	1.5±0.013	0.61±0.06	0.50±0.04	31.54±1.2
5FU 3	1.5±0.041	0.51±0.05	0.54±0.06	30.41±1.3
5FU 4	1.5±0.012	0.60±0.02	0.55±0.05	29.84±1.2
5FU 5	1.4±0.013	0.53±0.04	0.51±0.08	30.73±1.1
5FU 6	1.3±0.014	0.52±0.06	0.53±0.04	29.74±1.2
5FU 7	1.4±0.084	0.51±0.03	0.55±0.05	30.74±1.2
5FU 8	1.4±0.013	0.52±0.04	0.55±0.06	31.21±1.4
5FU 9	1.5±0.078	0.49±0.02	0.51±0.03	29.74±1.2
5FU 10	1.5±0.012	0.50±0.04	0.53±0.07	30.44±1.4

5FU 11	1.4±0.053	0.52±0.07	0.54±0.04	29.74±1.2
5FU 12	1.5±0.036	0.51±0.04	0.53±0.05	29.82±1.3
5FU 13	1.5±0.084	0.51±0.02	0.55±0.03	30.21±1.2
5FU 14	1.4±0.026	0.62±0.06	0.55±0.02	29.74±1.4
5FU 15	1.6±0.073	0.50±0.05	0.52±0.03	30.33±1.2
5FU 16	1.5 ±0.012	0.6±0.03	0.50±0.04	30.76±1.2
5FU 17	1.4±0.052	0.52±0.09	0.53±0.06	30.21±1.3

* We performed triple analyses on each sample. (n = 3)

Swelling ratio of multiparticulate

Swelling ratio of trial batches

The amount of growth to time was determined. Both the rate of hydration and the multiparticulate's weight rise were observed to boost the swelling ratio. Ciprofloxacin C3a, C5a, C3b, and C5b had a higher swelling ratio in the experimental batch than the other formulations. The amount that K3a, K5a, K3b, and K5b rise in the Ketoprofen trial batches was much higher than that of the other batches. Among the 5-fluorouracil formulations tested, 5FU3a, 5FU5a, 5FU3b, and 5FU5b exhibited the best batter swellability. The formulation's higher Chitosan content could be to blame. All of the batches slowly grow at first, as shown in Tables 3, 4, and 5. However, they reach their full size at different ratios. In his talk, Ibrahim El-Gibaly covered the topic of microparticle swelling and how it's affected by ambient pH. He said that lower pH values or water tend to have a larger swelling effect than higher ones.

Table 5: Ciprofloxacin swelling ratio results from clinical trials

Batch Code	Swelling ratio of multiparticulate adhering to the tissue In pH 7.4 Time/h							
	0	1	2	4	6	8	10	12
C1a	0	0.32 ±0.15	0.58±0.14	0.72±0.16	0.84±0.12	0.94±0.12	1.15±0.15	1.24±0.13
C2a	0	0.43±0.14	0.53±0.12	0.61±0.15	0.91±0.19	1.22±0.16	1.40±0.13	1.50±0.18
C3a	0	0.44±0.13	0.65±0.15	0.76±0.15	0.84±0.11	0.92±0.13	1.23±0.15	1.52±0.15
C4a	0	0.43±0.15	0.54±0.12	0.62±0.13	0.76±0.14	1.31±0.15	1.39±0.13	1.42±0.13
C5a	0	0.34±0.12	0.45±0.13	0.64±0.13	0.80±0.15	0.92±0.14	1.24±0.15	1.64±0.15
C1b	0	0.35±0.13	0.58±0.15	0.73±0.12	0.87±0.15	0.94±0.13	1.22±0.13	1.28±0.13
C2b	0	0.45±0.14	0.52±0.12	0.72±0.14	0.91±0.14	1.33±0.15	1.42±0.15	1.54±0.14
C3b	0	0.38±0.15	0.62±0.13	0.75±0.14	0.83±0.15	0.92±0.15	1.25±0.13	1.55±0.15
C4b	0	0.42±0.14	0.57±0.13	0.62±0.12	0.87±0.14	1.56±0.13	1.63±0.13	1.52±0.15
C5b	0	0.36±0.15	0.46±0.16	0.68±0.15	0.75±0.14	0.83±0.13	0.92±0.17	1.63±0.14

*We performed triple analyses on each sample. (n = 3)

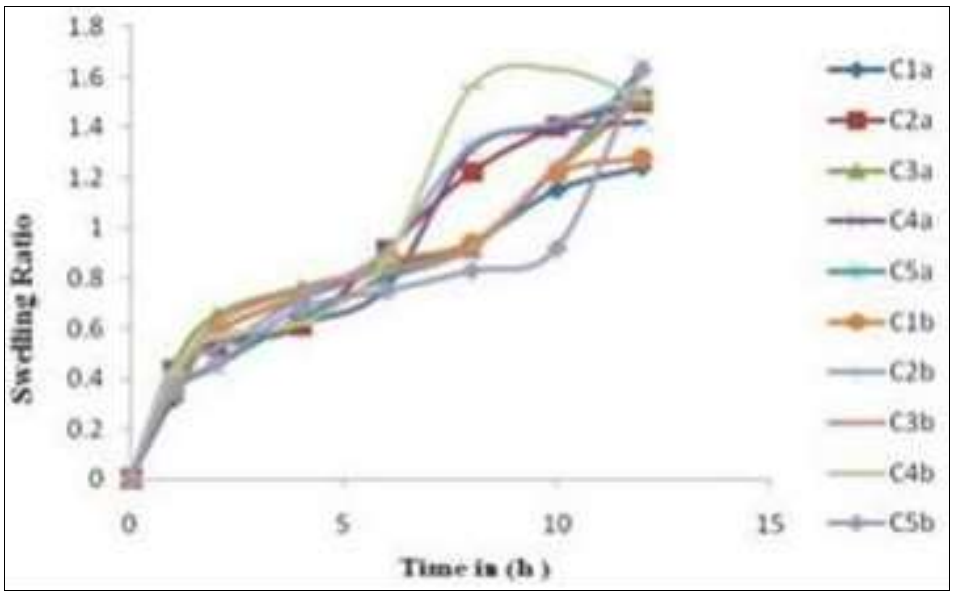

Fig 1: Swelling ratio of trial batches of Ciprofloxacin

Table 6: Swelling ratio of trial batches of Ketoprofen

Batch Code	Swelling ratio of multiparticulate adhering to the tissue							
	In pH 7.4							
	Time/h							
	0	1	2	4	6	8	10	12
K1a	0	0.40±0.15	0.51±0.15	0.64±0.16	0.75±0.13	0.86±0.12	1.19±0.15	1.28±0.12
K2a	0	0.45±0.14	0.53±0.13	0.63±0.15	0.92±0.19	1.23±0.14	1.30±0.13	1.51±0.18
K3a	0	0.42±0.13	0.65±0.15	0.76±0.15	0.84±0.14	0.92±0.13	1.22±0.15	1.42±0.12
K4a	0	0.48±0.15	0.54±0.14	0.68±0.13	0.86±0.14	1.36±0.15	1.41±0.13	1.50±0.13
K5a	0	0.32±0.12	0.47±0.15	0.66±0.12	0.73±0.16	0.84±0.14	1.41±0.15	1.70±0.15
K1b	0	0.34±0.14	0.58±0.15	0.73±0.13	0.87±0.15	0.94±0.13	1.23±0.12	1.28±0.13
K2b	0	0.45±0.14	0.52±0.13	0.88±0.14	0.94±0.14	1.33±0.12	1.42±0.12	1.54±0.14
K3b	0	0.38±0.15	0.62±0.16	0.75±0.14	0.83±0.14	0.92±0.15	1.25±0.15	1.45±0.15
K4b	0	0.47±0.14	0.58±0.13	0.72±0.12	0.87±0.13	1.56±0.16	1.62±0.12	1.52±0.15
K5b	0	0.36±0.15	0.46±0.16	0.68±0.14	0.75±0.12	0.93±0.13	1.31±0.17	1.65±0.14

We performed triple analyses on each sample. (n = 3)

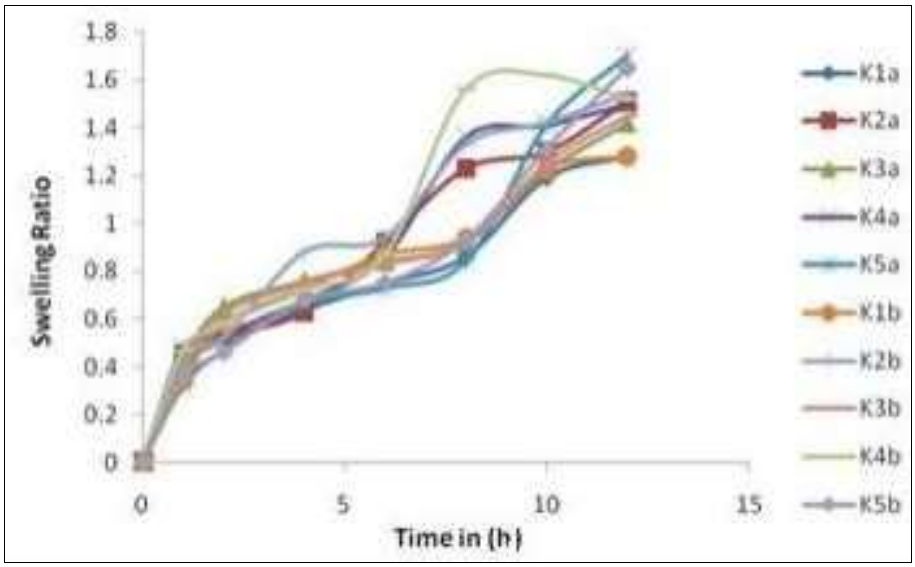

Fig 2: Swelling ratio of trial batches of Ketoprofen

Table 7: Swelling ratio of trial batches of 5-Fluorouracil

Batch Code	Swelling ratio of multiparticulate adhering to the tissue							
	In pH 7.4							
	Time/h							
	0	1	2	4	6	8	10	12
5FU1a	0	0.38±0.12	0.51±0.16	0.66±0.14	0.85±0.11	0.93±0.13	1.13±0.15	1.26±0.14
5FU2a	0	0.47±0.14	0.54±0.14	0.63±0.15	0.92±0.19	1.23±0.16	1.3±0.015	1.56±0.18
5FU3a	0	0.46±0.13	0.65±0.15	0.76±0.15	0.84±0.16	0.92±0.13	1.32±0.13	1.42±0.12
5FU 4a	0	0.48±0.14	0.55±0.14	0.63±0.13	0.76±0.13	1.36±0.14	1.46±0.12	1.54±0.13
5FU 5a	0	0.47±0.15	0.54±0.14	0.68±0.14	0.86±0.14	1.36±0.15	1.61±0.13	1.69±0.14
5FU 1b	0	0.35±0.14	0.58±0.13	0.73±0.15	0.87±0.14	0.94±0.14	1.30±0.16	1.38±0.14
5FU 2b	0	0.45±0.18	0.52±0.12	0.87±0.15	0.99±0.14	1.33±0.16	1.42±0.15	1.54±0.14
5FU 3b	0	0.38±0.15	0.62±0.15	0.75±0.14	0.83±0.15	0.92±0.15	1.25±0.15	1.45±0.15
5FU 4b	0	0.37±0.14	0.52±0.13	0.66±0.13	0.83±0.13	0.90±0.13	1.12±0.12	1.25±0.13
5FU 5b	0	0.36±0.15	0.46±0.16	0.68±0.15	0.75±0.14	0.83±0.15	0.92±0.17	1.66±0.14

We performed triple analyses on each sample. (n = 3)

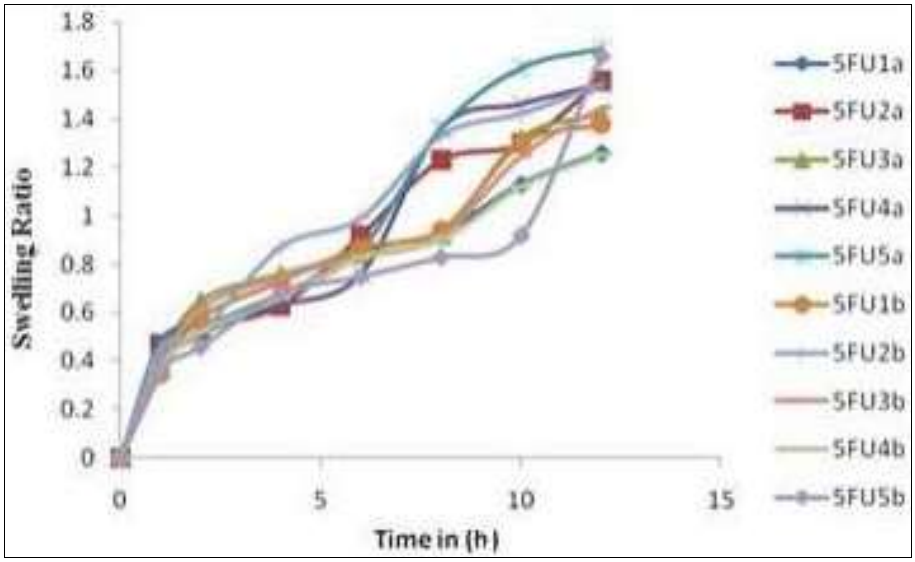

Fig 3: Swelling ratio of trial batches of 5-Fluorouracil

Swelling studies of factorial batches

The batch of Ciprofloxacin C4 had the highest swelling ratio, reading 1.81±0.15. It was chosen as the factorial batch with the highest swelling ratio. The swelling ratio for K6, K10, K14, and K16 was higher than the other three doses of Ketoprofen. The batch K10 had the most growth., measuring 1.81±0.18. Batch 5FU15 out of the four 5-fluorouracil factorial batches exhibited the highest swelling, at 1.83±0.12, in comparison to the other formulations. Batches 5FU11, 5FU12, 5FU13, and 5FU15 all demonstrate greater swellability. The formulation's higher Chitosan content could be to blame. All of the batches gradually inflate at first, but as shown in tables 6, 7, and 8, they reach their maximum swelling at varying concentrations.

Table 8: Swelling ratio of factorial batches of Ciprofloxacin

Batch Code	Swelling ratio of multiparticulate adhering to the tissue							
	In pH 7.4							
	Time/h							
	0	1	2	4	6	8	10	12
C1	0	0.42±0.13	0.52±0.13	0.64±0.16	0.75±0.12	0.98±0.16	1.29±0.15	1.68±0.12
C2	0	0.45±0.14	0.54±0.14	0.62±0.15	0.94±0.15	1.24±0.16	1.34±0.12	1.62±0.17
C3	0	0.43±0.13	0.65±0.15	0.76±0.15	0.84±0.13	0.92±0.13	1.35±0.15	1.62±0.12
C4	0	0.48±0.15	0.54±0.18	0.68±0.18	0.86±0.14	1.36±0.15	1.61±0.13	1.81±0.15
C5	0	0.42±0.12	0.57±0.17	0.57±0.15	0.74±0.15	0.94±0.14	0.94±0.15	1.61±0.15
C6	0	0.45±0.13	0.58±0.16	0.73±0.14	0.87±0.17	0.98±0.13	1.27±0.13	1.53±0.13
C7	0	0.55±0.14	0.52±0.13	0.78±0.15	0.93±0.16	1.31±0.16	1.42±0.12	1.68±0.14
C8	0	0.48±0.15	0.62±0.14	0.75±0.14	0.83±0.15	0.92±0.15	1.25±0.14	1.55±0.15
C9	0	0.57±0.14	0.58±0.14	0.72±0.12	0.87±0.14	1.26±0.13	1.44±0.17	1.52±0.15
C10	0	0.46±0.14	0.56±0.15	0.68±0.15	0.75±0.16	1.23±0.11	1.42±0.16	1.53±0.14
C11	0	0.49±0.15	0.61±0.14	0.74±0.15	0.85±0.13	0.96±0.12	1.19±0.14	1.60±0.12
C12	0	0.47±0.13	0.54±0.15	0.63±0.13	0.92±0.19	1.23±0.16	1.36±0.15	1.56±0.18
C13	0	0.54±0.13	0.65±0.15	0.76±0.16	0.84±0.17	0.92±0.13	1.32±0.16	1.62±0.12
C14	0	0.58±0.12	0.54±0.13	0.68±0.11	0.86±0.14	1.36±0.15	1.51±0.13	1.64±0.12
C15	0	0.42±0.12	0.57±0.14	0.67±0.14	0.74±0.15	0.84±0.14	0.94±0.15	1.51±0.15
C16	0	0.45±0.16	0.58±0.13	0.63±0.16	0.87±0.15	0.94±0.13	1.27±0.18	1.58±0.13
C17	0	0.55±0.15	0.52±0.12	0.78±0.15	0.98±0.14	1.34±0.16	1.42±0.16	1.54±0.14

Conclusion

Covering the mucosal retention with a 10% w/w mix of eudragit and L also helps target the multiparticulate in the gut. This study describes an innovative new way to send drugs to the gut. It uses multiparticulate chitosan and guar gum that are covered with eudragit S and L 100 at a 10%

weight-to- weight ratio.

References

1. Sinha VR, Kumria R. Binders for colon specific drug delivery: an *in vitro* evaluation. Int. J Pharma. 2022;249:23-31.
2. Leong CW, Newton JM, Basit AW, Podczecka F, Cummings JH, Ring SG, *et al*. The formation of colonic digestible films of amylose and ethylcellulose from aqueous dispersions at temperatures below 37 °C. Eur. J Pharma Biopharma. 2022;54:291-297.
3. Gonzalez-Rodrıgueza ML, Maestrellib F, Murab P, Rabascoa AM. *In vitro* release of sodium diclofenac from a central core matrix tablet aimed for colonic drug delivery. Eur. J Pharma Sci. 2023;20:125-131.
4. Sinha VR, Kumria R. Microbially triggered drug delivery to the colon. Eur. J Pharma Sci. 2023;18:3-18.
5. Valentine CI, Kendall RA, Basit AW. Drug delivery to colon. The drug deliveries Report Sprig/summer 2014, Pharma ventures Ltd.; c2014.
6. Davis, *et al*. The *in-vivo* evaluation of an osmotic device (osmet) using gamma scintigraphy. J Pharm Pharmacol. 2014;36:740-742.
7. Mirelman D, De Meester F, Storlasky T, Burchard GD, Ernest-Cabera K, Wilchek M, *et al*. Effects of Covalently bound silica-nitroimidazole drug particles on Entamoeba histolytica. J Infect Dis. 2019;159:303-309.
8. Tozaki H, Komoike J, Tada C, Maruyama T, Terabe A, Suzuki T, *et al*. Chitosan capsules for colon-specific drug delivery: Improvement of insulin absorption from the rat colon. J Pharm Sci. 2017;86:1016-1021.
9. Bauer KH, Kesselhut JF. Novel pharmaceutical excipients for colon targeting. S.T.P. Pharma Sci. 2015;5:54-59.
10. Stevens H, Wilson C, Welling P, Bakhshaee M, Binns J, Perkins A, *et al*. Evaluation of Pulsincap™ to provide regional delivery of dofetilide to the human GI tract. Int J Pharm. 2022;236:27-34.
11. Beale JM. In Anti-infective Agents. Wilsons and Gisvold's Textbook of organic medicinal & pharmaceutical chemistry, 11th edn. John H Block, John M. Beale, Jr., eds. Lipincott Williams and Wilkins USA. 259-260.
12. Azad Khan KA, Piris J, Truelove SC. An experiment to determine the active therapeutic moiety of Sulphasalazine. Lancet. 2017;2:892-895.
13. Bogentoft C, Eskilsson C, Jonsson UE, Lagerstorm PO, Lovgren K, Rosen L, *et al*. Delivery of drug to the colon by means of a new microencapsulated oral dosages form. Acta Pharm Suec. 2013;20:311-314.
14. Watkinson G. Sulphasalazine: A Review of forty years' experience drugs. 32(1):1-11.