

## ***Supplementary information***

### *S2.5. Flow-ability parameters*

Any material's capacity to flow determines its suitability as a pharmaceutical excipient. In order to determine the flow properties of CL-AX to use it as a pharmaceutical excipient, a number of flow-ability parameters including the angle of repose ( $\theta$ ), bulk density ( $Db$ ), tapped density ( $Dt$ ), Carr's index ( $Ci$ ), and Hausner ratio ( $Hr$ ) were calculated [1].

#### *Angle of repose*

The frictional force between the CSH particles (in powder form) was revealed by the angle of repose ( $\theta$ ). The angle of repose was measured using the fixed funnel method described elsewhere [1]. In short, CSH powder was allowed to descend from the open perimeter of a funnel that was placed on a tripod stand until the lower tip of the funnel and the apex of the powder heap barely touched. To determine the angle of repose using the equation, the height ( $h$ , cm) and radius ( $r$ , cm) of the heap's base were measured (Eq. 1).

$$\text{Tan}\theta = \frac{h}{r} \tag{1}$$

#### *Bulk and tapped density*

The bulk volume ( $Vb$ ) of a precisely weighed CSH powder ( $Wi$ , 1000 mg) was measured in a graduated cylinder. To determine the ultimate tapped volume ( $Vt$ ), the cylinder was tapped 100 times. Equations (2) and (3) were used to determine the bulk density ( $Db$ ) and tapped density ( $Dt$ ), respectively.

$$D_b = \frac{W_i}{V_b} \quad (2)$$

$$D_t = \frac{W_i}{V_t} \quad (3)$$

#### *Hausner ratio and Carr's index*

Any material's compressibility/Carr's index (Ci) and Hausner ratio (Hr) provide details about how the particles are packed. Eqn. (4) and (5) were used to get the Hr and Ci of CSH, respectively.

$$H_r = \frac{D_t}{D_b} \quad (4)$$

$$C_i = \left[1 - \frac{D_b}{D_t}\right] \times 100 \quad (5)$$

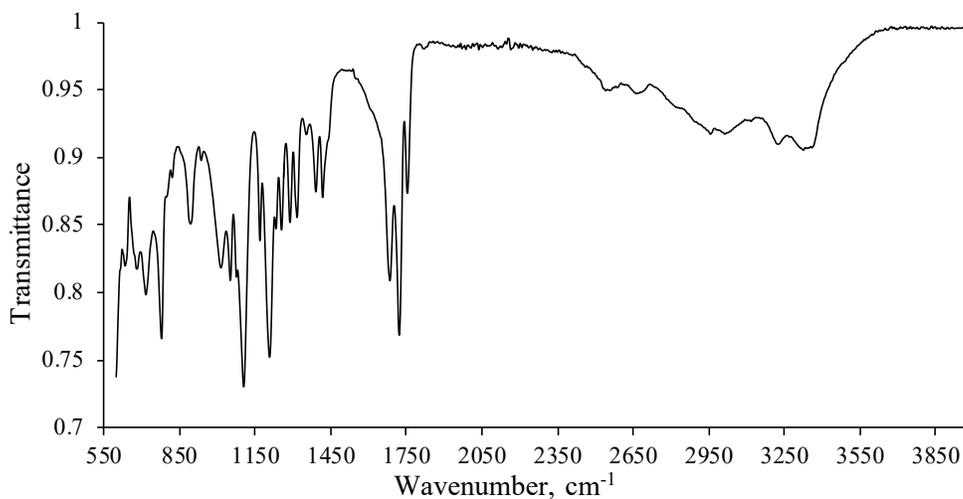
#### *Moisture content and loss on drying*

In a vacuum oven set to 105 °C, the CSH (0.1 g) was dried out for one hour. To determine the moisture content (eqn. (6)) and drying loss (eqn. (7)), the initial weigh ( $W_i$ , before drying) and the final weight ( $W_f$ , after drying) of CSH were recorded.

$$\text{Moisture content (\%)} = \frac{W_i - W_f}{W_f} \times 100 \quad (6)$$

$$\text{Loss on drying (\%)} = \frac{W_i - W_f}{W_i} \times 100 \quad (7)$$

#### **FTIR analysis**



**Fig. S1:** FTIR spectrum of citric acid.

**Table S1**

Body weight (g) of treated and control group of rabbits (mean  $\pm$  SD)

Parameters	Group "I"	Group "II"	Group "III"	Group "IV"
Pretreatment	1235.68 $\pm$ 10.59	1403.94 $\pm$ 11.74	1127.89 $\pm$ 10.85	1273.07 $\pm$ 9.31
Day 1	1232.34 $\pm$ 13.24	1401.27 $\pm$ 10.86	1125.54 $\pm$ 11.05	1270.43 $\pm$ 8.66
Day 2	1230.68 $\pm$ 09.89	1400.60 $\pm$ 12.76	1124.54 $\pm$ 10.30	1268.43 $\pm$ 9.86
Day 3	1234.01 $\pm$ 12.65	1405.27 $\pm$ 8.30	1126.21 $\pm$ 9.63	1272.76 $\pm$ 7.64
Day 5	1244.13 $\pm$ 10.91	1414.47 $\pm$ 9.40	1135.21 $\pm$ 8.25	1282.44 $\pm$ 9.94
Day 7	1253.46 $\pm$ 09.16	1422.72 $\pm$ 8.73	1146.54 $\pm$ 9.92	1291.26 $\pm$ 10.56

Day 14	1272.10± 10.47	1441.38±11.05	1164.28±10.51	1311.23±9.20
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**Table S2**

Mean values of food (g) and water consumption (mL) of control and treated groups of rabbits

Parameters	Group “A”	Group “B”	Group “C”	Group “D”
<b>Water</b>				
<b>consumption (mL)</b>				
Pretreatment	21.62±1.16	19.84±1.40	20.38±1.46	21.36±1.52
Day 1	20.39±1.11	19.56±1.91	20.57±1.83	21.50±1.28
Day 2	21.37±1.68	20.51±1.76	21.74±1.19	20.44±1.39
Day 3	21.95±1.17	19.28±1.08	20.18±1.75	21.51±1.60
Day 7	22.15±1.40	20.74±1.47	20.79±1.91	22.41±1.13
Day 14	21.46±1.48	19.81±1.91	21.27±1.31	22.76±1.59
<b>Food consumption (g)</b>				
Pretreatment	21.30±1.29	20.91±1.14	21.54±1.35	19.85±1.75
Day 1	21.49±1.82	19.58±1.75	20.05±1.58	18.74±1.72

Day 2	22.62±1.30	20.71±1.15	21.70±1.54	19.43±1.27
Day 3	21.58±1.69	21.08±1.23	20.96±1.03	20.56±1.42
Day 7	20.48±1.38	21.61±1.74	21.17±1.09	19.92±1.66
Day 14	21.57±1.28	20.79±1.64	22.47±1.02	20.71±1.43

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\* $p < 0.05$  is a significant difference as compared to the control

### Table S3

Organ weight of rabbits (Group “IV”).

Organs	Absolute organ weight of rabbits (g)	Relative weight (%)
Heart	2.769	0.304
Kidney (pair)	5.235	0.575
Stomach(empty)	7.856	0.862
Pancreas	1.963	0.215
Lungs	5.148	0.565
Intestines (empty)	29.484	3.236

Liver	31.267	3.432
Spleen	0.843	0.093

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### Reference

- [1] L. Lachmann, H.A. Liberman, J.L. Kanig, Theory and practice of industrial pharmacy, third ed., Lea and Febiger, Philadelphia, 1987.