

From Oil to Powder to Capsules – The Natural Way

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Introduction

Industries are looking to add natural high-sources of vitamins, probiotics, omega 3-6-9 fatty acids, antioxidants, amino acids and hemp to their natural supplement products. Often in form of an oil or oily powder. Talking about the latter, manufacturers can achieve some benefits when using microencapsulation for oil powders. Especially if the oil powder is then filled into hard gelatin capsules, precision dosing of exact amounts of ingredients or nutrients can be achieved. Flavor and odor masking can minimize unpleasant tastes and smells associated with certain nutrients. Protection from moisture, acids, heat and oxygen. It enhances stability, bio-availability and delivery. As well as ease of handling due to dry and free flowing.

This evaluation examines whether it is possible to incorporate oily substances in powder with purely natural ingredients and to encapsulate the product in a simple way.

The following three applications are to be simulated – using sunflower oil as an oil substitute:

- 1) 20 mg of hemp in a size 0 capsule
- 2) 22.5 I.U. of Vitamin E, ca. 15 mg of Vitamin D3 in a size 1 capsule
- 3) 30 mio CFU of probiotics in a size 0 capsule/Oil is used to make the probiotics more stable

Materials and Methods

To incorporate the sunflower oil into powder (CompactCel® MAB, BIOGRUND) the oil was blended into the CompactCel® MAB (CC MAB) by using a high shear mixer. The absorbance material is based on only natural and organic ingredients. The oil was added step by step into the CC MAB to guarantee a homogeneous distribution and to avoid clumping. The ratio was 1:3 oil/powder.



Three different trials using two different formulations were performed with the oily powder. For the encapsulation process a Syntegon (formerly Bosch) GKF 705 was used, with different tamping pin heights, bowl fill heights and machine speeds (rpm). The right speed, tamping pin height and formulation of the oil powder blend is crucial for the success of the encapsulation process of hard gelatin capsules.

Table 1: Devices, formulations and parameters

Used encapsulation device:	GKF 705, Syntegon (formerly Bosch) Tamping Pin Settings 7, 10, 13, 19 mm Dosing Disk Thickness 19.7 mm
Hard Gel Capsules:	Size 0, Material HPMC

Table 2: Formulation Set 1

Formulation Set 1 (ratio 1:1)	Percentage %	Target weight (mg)	Oil content (mg)	Oil content (%w/w)
CC MAB including (oil 25%w/w)	50	292	73	12.50
Flow aid CompactCel® FLO 305.17	50	292		
Total	100	584		

Formulation Set 1 12.5% Oil in powder

	7	10	13	16	19
Tamping Pin Heights (mm)	7	10	13	16	19
Powder Bowl Height (mm)	15	15	20	20	20
Cycles Per Minute (RPM)	110	100	110	140	100
Mean (mg)	532	562	584	572	513
StDev (mg)	48	31	22	25	54
%RSD	9.06%	5.52%	3.75%	4.39%	10.63%

Dosing Disk Thickness 19.7 mm

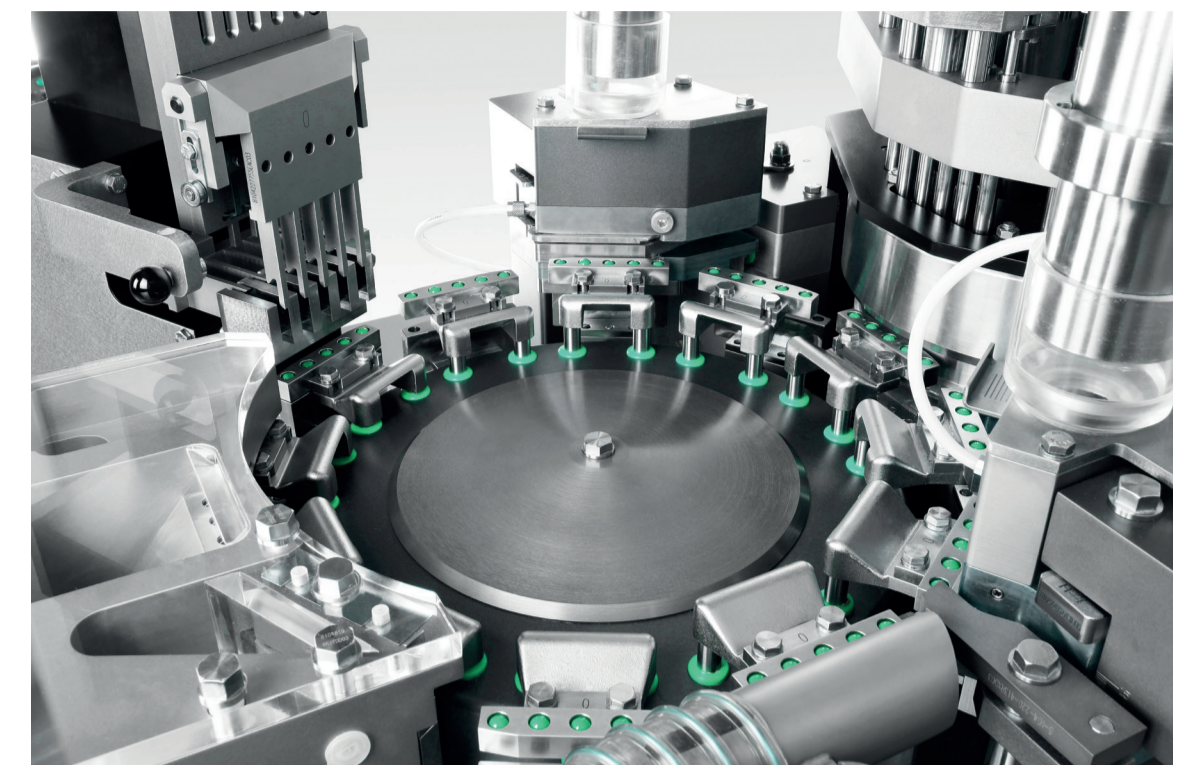
Table 3: Formulation Set 2

Formulation Set 2 (ratio 1:1)	Percentage %	Target weight (mg)	Oil content (mg)	Oil content (%w/w)
CC MAB including (oil 25%w/w)	37.67	220	55	9.42
Flow aid CompactCel® FLO 305.17	62.33	364		
Total	100	584		

Formulation Set 2 9.4% Oil in powder

	7	10	13	16	19
Tamping Pin Heights (mm)	7	10	13	16	19
Powder Bowl Height (mm)	20	20	25	30	30
Cycles Per Minute (RPM)	110	140	110	110	140
Mean (mg)	564	508	559	563	553
StDev (mg)	19	22	13	13	14
%RSD	3.36%	4.34%	2.26%	2.23%	5.59%

Dosing Disk Thickness 19.7 mm



Results and Discussion

As mentioned at the beginning, the following three applications serve as a basis for the orientation of our simulation:

Substance	Target	Details	Capsule size	Oil content
Hemp	20 mg of Hemp in a size 0 capsule	will be approx. 30 mg oil (containing 20 mg CBD)	Size 0 capsule = 500 mg	6% of oil must be in the capsule
Vitamin E	22.5 I.U. of Vitamin E, ca 15 mg of Vitamin D3 in 1 capsule	will be approx. 15 mg oil (containing 15 mg Vitamin E)	Size 1 capsule = 350 mg	ca 4% of oil must be in the capsule
Probiotics	30 mio CFU of probiotics in a size 0 capsule / Oil is used to make the probiotics more stable	will be approx. 30 mg oil (containing 30 mio CFU of probiotics)	Size 0 capsule = 500 mg	6% of oil must be in the capsule

In the nutraceutical industry a relative standard deviation (RSD) below 5% of filled capsules is acceptable. The results of Set 1 (ratio 1:1) showed a RSD of 3.75%. This means a good powder flow in combination with the right process parameters was given to achieve the desired result.

In the pharmaceutical industry a relative standard deviation (RSD) below 3% of filled capsules is acceptable. The results of Set 2 (ratio 1:2) showed a RSD of 2.23%. This means a good powder flow in combination with the right process parameters was given to achieve the desired result.

As a result, a hard gelatin capsule can be filled with the natural powder blend CC MAB that can take 12.5% (Set 1) and 9.5% (Set 2) oil in total per hard gelatin capsule. This is much more than the assumed amount in one capsule of our underlying applications (Hemp 6%, Vitamin E 4%, probiotics 6%).

Comparing these results with the underlying applications, it can be said that the goal of filling oil to powder into hard gelatin capsules is a straight forward process. Thus, this process is a viable alternative to liquid-filled capsules and soft gels or pure oil as a dosage form if the right equipment, parameters and ingredients are used.