

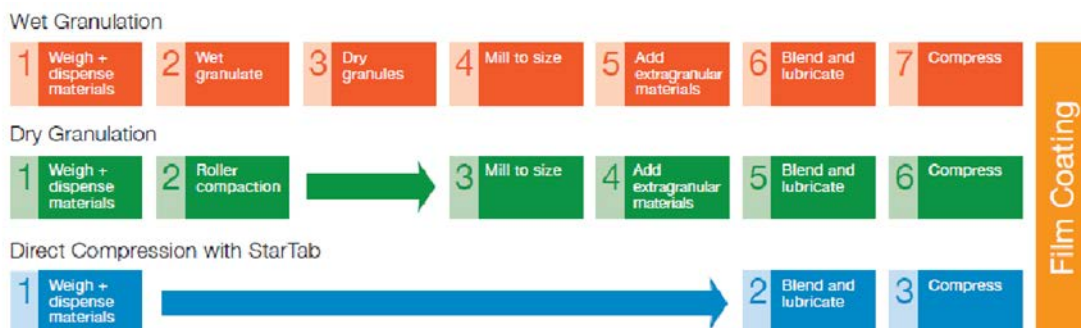
## Overcoming Dietary Supplement Challenges – Vitamin C

### Formulation of Dietary Supplements

Direct compression of dietary supplements may be challenging due to their high concentration of active ingredients and poor physicochemical properties of the ingredients. Typical challenges include:

- Sensitivity to environmental humidity, heat and light
- Poor flow and compressibility
- Possible interactions between active ingredients in a single dosage form
- Strong odor and/or bitter taste

Therefore, formulators must understand the properties of the active ingredients and choose the right excipients that will improve the formulation properties for successful manufacture and shelf-life stability of the finished dosage form.



### The Challenge

Vitamin C (ascorbic acid) is a widely used dietary supplement for boosting the immune system<sup>1</sup>. It is used in a broad range of doses and is highly soluble in water. Poor flow and compressibility present formulation and manufacturing challenges. Vitamin C is also moisture sensitive and prone to undergo degradation on storage. This study demonstrates the use of StarTab®, Directly Compressible Starch in simplifying the formulation and manufacturing process leading to stable film coated vitamin C tablets.

### Materials and Methods

Robust film-coated immediate release tablets of vitamin C (200 mg dose) were developed using direct compression (Table 1) in this case study.

A 1 kg batch of the formulation (Table 1) was prepared by mixing the main ingredients for 10 minutes, adding lubricant and mixing for a further 3 minutes. Tablets were compressed using 13/32" (10.3 mm) standard round concave B-tooling, 23 kN main compression force. Final tablets were coated with a brown

pigmented Nutrafinish®, High Performance Coating, to 4% weight gain (w/w), in a 12” perforated coating pan (O’Hara Labcoat II). Coating parameters are shown in Table 2.

**Table 1: Composition of Immediate Release Vitamin C Tablets**

Core Tablet Ingredients	% w/w	mg / tablet
Vitamin C (Ascorbic acid)	50.00	200.00
StarTab	24.75	99.00
Microcrystalline Cellulose (90µm) / Avicel 102	24.75	99.00
Magnesium Stearate	0.50	2.00
<b>Final Core Tablet Weight</b>	<b>100.00</b>	<b>400.00</b>

**Table 2: Film Coating Process Parameters**

Coating System	Nutrafinish® Brown
<b>Solid Content (% w/w)</b>	25
<b>Pan Speed (rpm)</b>	13
<b>Air Volume (CFM)</b>	125-142
<b>Atomizing Air Pressure (psi)</b>	20
<b>Pattern Air Pressure (psi)</b>	20
<b>Spray Rate (g/min)</b>	8-9
<b>Inlet Temperature (° C)</b>	58-60
<b>Exhaust Temperature (° C)</b>	38-40
<b>Product Temperature (° C)</b>	32-40

## Results

The use of StarTab improved the powder properties of vitamin C, making the formulation suitable for direct compression (Table 3). The formulation compressed easily, yielding defect-free tablets with good physical properties. Table 4 shows the final tablet properties of uncoated and coated vitamin C tablets. The tablets were successfully film coated, resulting in glossy, smooth tablets (Figure 1). All tablets met the USP specification<sup>2</sup> of complete tablet disintegration in less than 30 minutes. Additionally, coated tablets were tested for dissolution resulting in >90% of vitamin C released within the first 10 minutes (Figure 2).

**Table 3: Comparative Powder Properties**

Property	Vitamin C	Formulation Blend
Bulk density (g/mL)	0.81	0.63
Compressibility index (%)	32.00	23.23
Particle size d(0,5) (µm)	154.36	111.63
Flow rate (g/min)	Did not flow (30 mm)	36.7 (4 mm)
Overall Flow	Very poor	Flowable

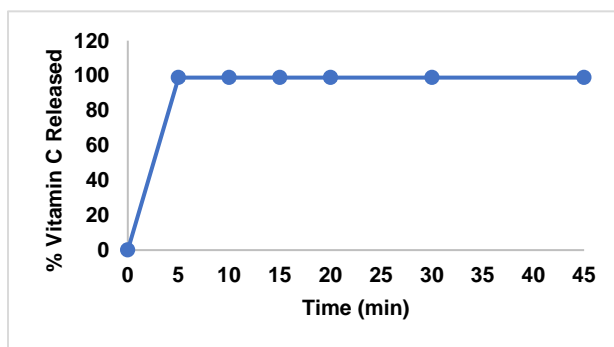
**Table 4: Properties of Vitamin C Immediate Release Tablets**

Property	Uncoated Tablets	Coated Tablets
Weight (mg)	401.51 ± 1.86	423.50 ± 2.40
Thickness (mm)	5.17 ± 0.03	5.21 ± 0.03
Hardness (kP)	11.90 ± 2.07	11.20 ± 1.10
Friability, %	0.0 ± 0.0	0.0 ± 0.0
Disintegration time (minutes)	1.23 ± 0.20	1.42 ± 0.12

**Figure 1: Film Coated Ascorbic Acid Tablets**



**Figure 2: Drug Release from Coated Vitamin C Tablets**



## Conclusion

The use of StarTab, directly compressible starch, in the formulation of immediate release vitamin C tablets, shows simplicity of the formulation and process. StarTab improved the formulation powder flow and compressibility. Tablets developed were robust and easily coated with Nutrafinish, High Performance Coating for a perfect finish.

## StarTab Overcomes Challenges of Poor Flow and Compressibility

StarTab supports the development of robust directly compressible tablets for a hydroscopic ingredient with poor flow characteristics.

## Think Direct Compression, Think StarTab.

- Elimination of glidant and superdisintegrant in tablet formulation
- Excellent powder flow, blend uniformity and tablet weight uniformity
- Superior compressibility with fast disintegration
- Simplified formulation and process

## References

1. Zelman, Kathleen. (2010). The Benefits of Vitamin C. <https://www.webmd.com/diet/features/the-benefits-of-vitamin-c#1>
2. USP 32 – Dietary Supplements I <2020> Disintegration and Dissolution of Dietary Supplements

The information contained herein, to the best of Colorcon, Inc.'s knowledge is true and accurate. Any recommendations or suggestions of Colorcon, Inc. with regard to the products provided by Colorcon, Inc. are made without warranty, either implied or expressed, because of the variations in methods, conditions and equipment which may be used in commercially processing the products, and no such warranties are made for the suitability of the products for any applications that you may have disclosed. Colorcon, Inc. shall not be liable for loss of profit or for incidental, special or consequential loss or damages.

Colorcon, Inc. makes no warranty, either expressed or implied, that the use of the products provided by Colorcon, Inc., will not infringe any trademark, trade name, copyright, patent or other rights held by any third person or entity when used in the customer's application.

For more information, contact your Colorcon representative or call:

North America	Europe/Middle East/Africa	Latin America	India	China
+1-215-699-7733	+44-(0)-1322-293000	+54-1-5556-7700	+91-832-6727373	+86-21-61982300

You can also visit our website at [www.colorcon.com](http://www.colorcon.com)



© BPSI Holdings LLC, 2020.

The information contained in this document is proprietary to Colorcon and may not be used or disseminated inappropriately.

All trademarks, except where noted, are property of BPSI Holdings, LLC.

ads\_2020\_StarTab\_vitC