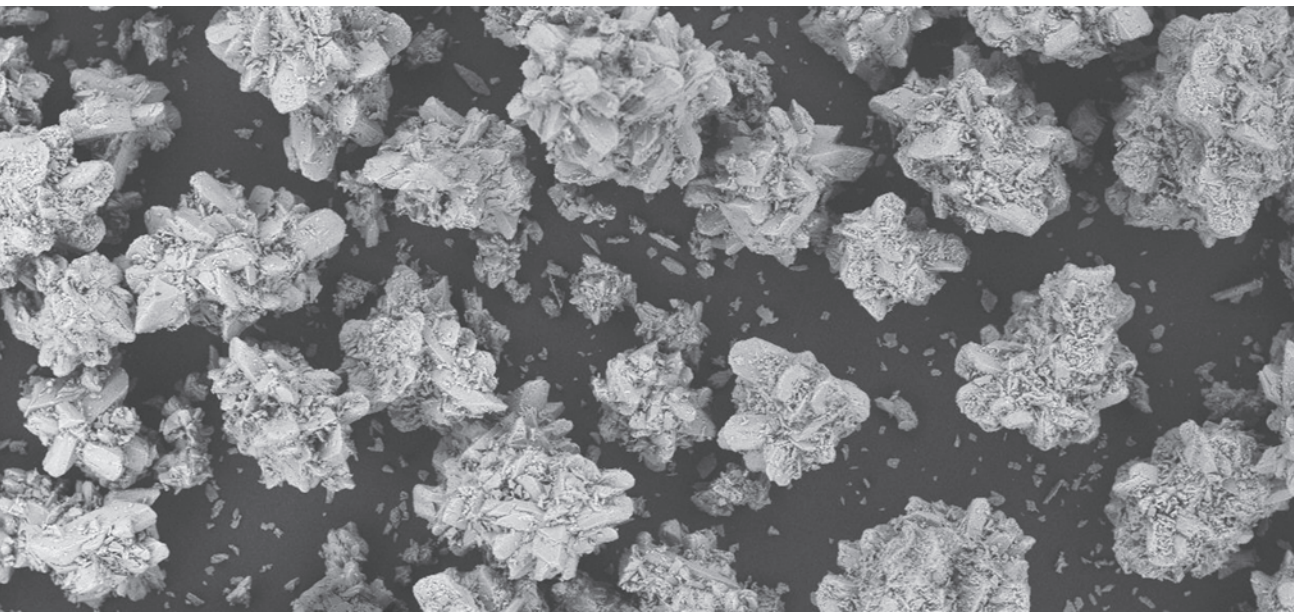
EMCOMPRESS®

Calcium Phosphates



Decades of Proven Quality and Functionality

Functional Filler
Flow Enhancer for High Speed Tableting
Calcium and Phosphate Fortification

JRS PHARMA *The Global Excipient Maker* JRS FAMILY A Member of the JRS Group

EMCOMPRESS®

Calcium Phosphates

Introduction

EMCOMPRESS® Calcium Phosphates are water-insoluble functional fillers for wet granulation and direct compression applications.

EMCOMPRESS® offers improved flow for all powder mixtures, including poorly flowing APIs and plant extracts.

EMCOMPRESS® is available as

- Anhydrous Calcium Hydrogen Phosphate (DCP anhydrous)
- Calcium Hydrogen Phosphate Dihydrate (DCP dihydrate)
- Calciumphosphate (TCP)

and in different particle sizes ranging from large particles for direct compression to fine powders for wet granulation.

Physical Properties

- White, crystalline powder
- Water-insoluble
- High bulk density
- Spherical shape (DC grades)
- Neutral taste
- Good flowability
- Low elastic recovery
- Deforms by brittle fracture

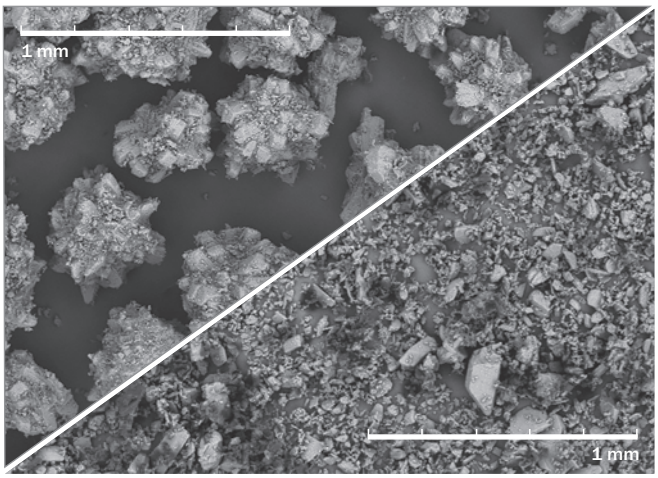


Fig. 1 Micrograph of **EMCOMPRESS® Premium DC / Powder**

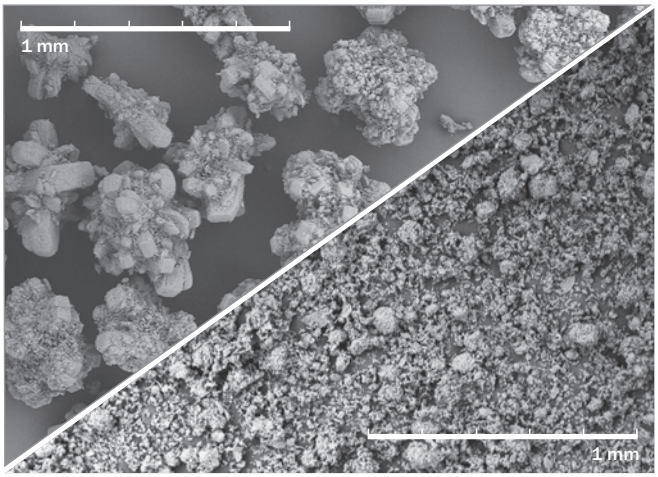


Fig. 2 Micrograph of **EMCOMPRESS® Anhydrous DC / Powder**

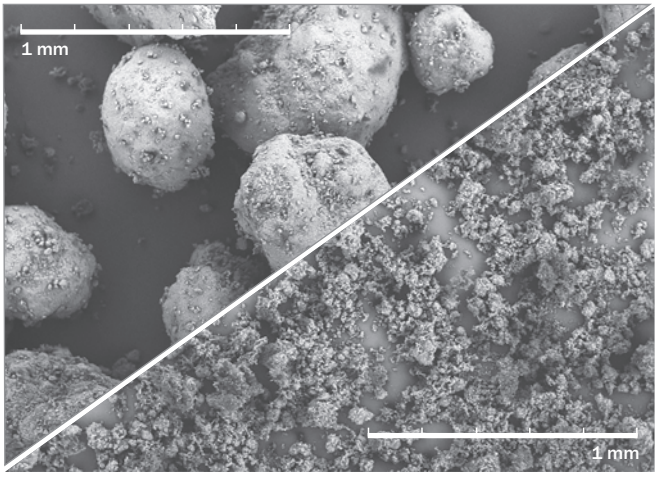
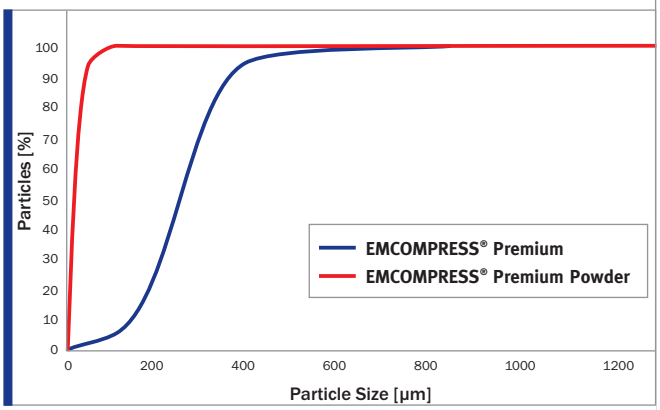
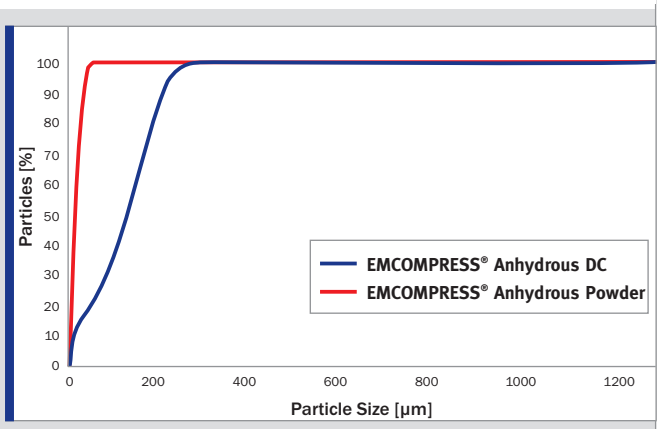
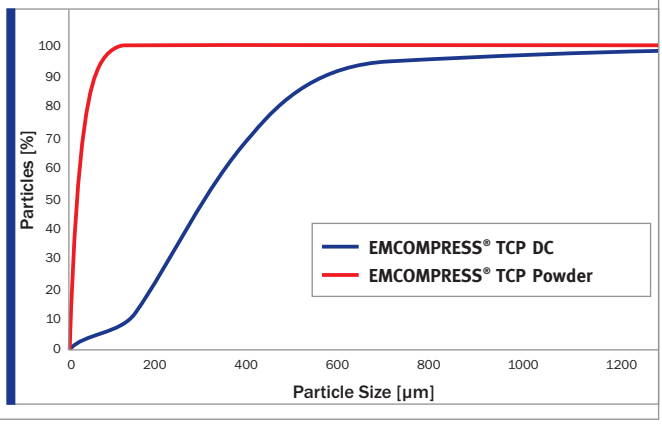


Fig. 3 Micrograph of **EMCOMPRESS® TCP DC / Powder**

	Grade	Application	BD [g/mL]	PSD
EMCOMPRESS® Premium	DC	Direct Compression	0.84	
	Powder	Wet Granulation Soft Gel Capsules	0.45	
EMCOMPRESS® Anhydrous	DC	Direct Compression	0.65	
	Powder	Wet Granulation Soft Gel Capsules	0.57	
EMCOMPRESS® TCP	DC	Direct Compression	0.88	
	Powder	Wet Granulation	0.47	

Note: The above given PSD curves and density values are for informational purposes only and not used for release testing of any **EMCOMPRESS®** type or a part of the specification.

Applications

- Direct compression (DC grades)
- Wet granulation (powder grades)
- Hard gel capsule filling (DC grades)
- Soft gel capsule filling (powder grades)
- Chewable tablets
- Herbal and sticky APIs
- Calcium fortification

Technical Data and Application

Tablet Binding Mechanisms

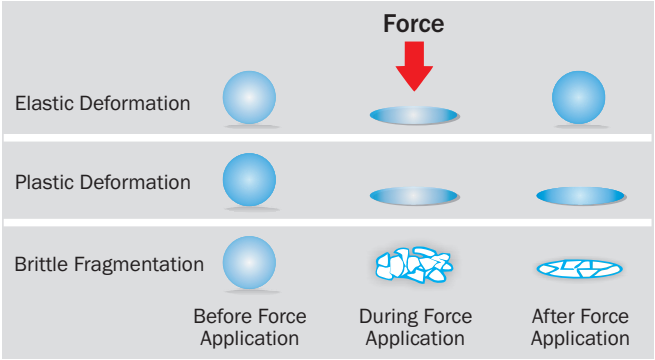
Various excipients exhibit different behavior upon compaction. After the application of compression force, they can either deform elastically or plastically, or they can fragment into brittle pieces.

Elastic materials deform upon the application of pressure, but regain most of their original shape after removal of the force. This elastic recovery can, for example, be seen in many starches. It leads to less stable tablets, which tend to be difficult to handle.

In contrast, **plastic materials** are deformed upon the application of force, but when the force is removed, they stay in their deformed form and do not restore their former shape. A typical example of this type of material is microcrystalline cellulose.

Brittle materials form a category of their own. If they are exposed to force, they break into many small pieces at first – just as glass breaks into shards. These small pieces are compacted into one big particle upon further exposure to force. These secondary particles are very dense and stick together well. Typical members of this class of excipients are calcium phosphates such as **EMCOMPRESS®**.

Most excipients have a preferred mechanism of deformation, but they commonly display small shares of the other mechanisms as well.



Pic. 1 Deformation Mechanism

1. Low Strain Rate Sensitivity

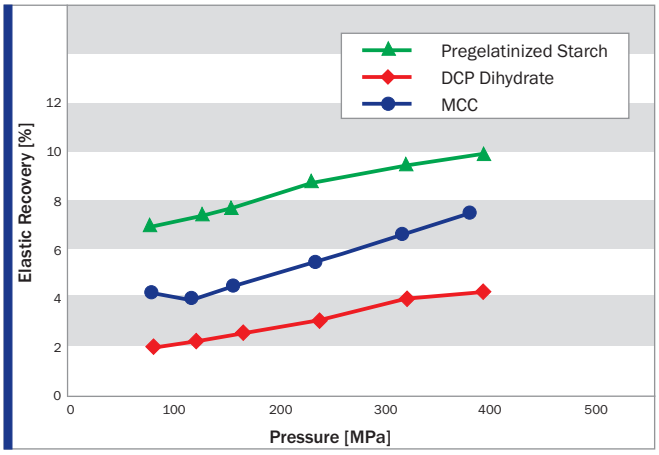
EMCOMPRESS® Calcium Phosphates are brittle and break into small pieces immediately after the application of compression force and develop their binding abilities.

In contrast, plastic deformation is dependent on the time of force application. Thus, increasing the tableting speed for a powder mixture containing mainly plastically deforming materials leads to a decrease in tablet hardness, while the mechanical strength of the tablet remains unchanged if mainly brittle materials are used. **EMCOMPRESS®**-based formulations are, therefore, highly suited for scale-up to high speed production.

2. Low Elastic Recovery

The share of elastic recovery is minimal for calcium hydrogen phosphate dihydrate, while the share of elastic recovery for pregelatinized starch is almost four times as high. The elastic recovery of microcrystalline cellulose is about twice the value of calcium hydrogen phosphate dihydrate.

This means that calcium hydrogen phosphate dihydrate is nearly free of elastic recovery and tablets made from calcium hydrogen phosphate will not regain size after compression. Thus, such tablets show a lower tendency towards capping and lamination.

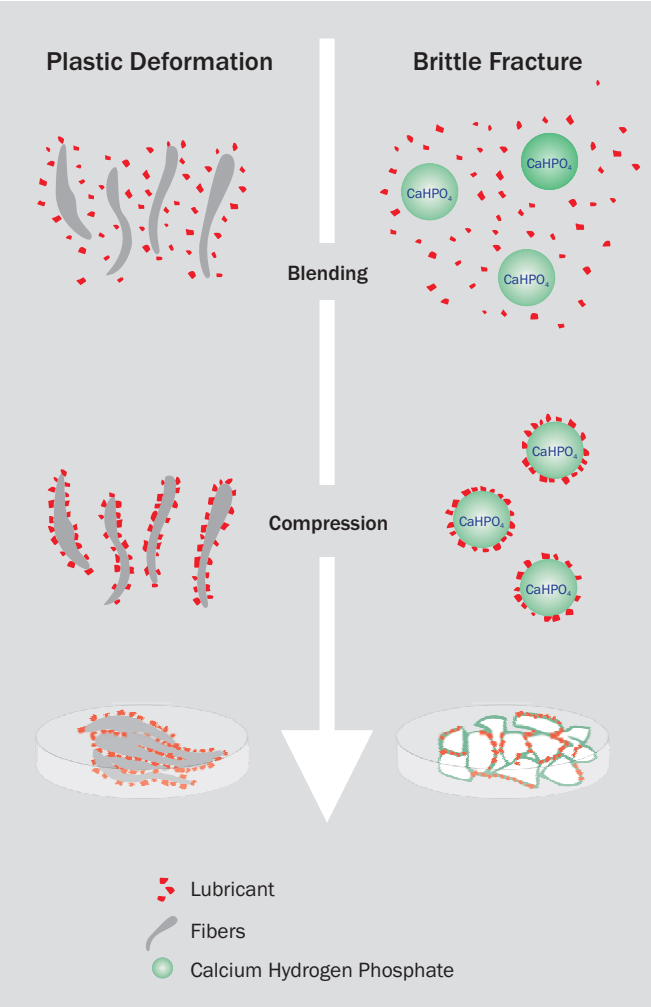


Graph 1 Adapted from: Holger Schlack, PhD Thesis, Freiburg, Germany

3. Low Lubricant Sensitivity

Lubricants are needed for the smooth ejection of tablets from the die. Within a tablet itself, lubricant is not needed; it even affects tablet hardness negatively. Wherever a lubricant is blended with other excipients, it forms a thin, slippery layer on the outside of the powder particles. If elastic or plastic particles are compressed, this layer impedes the cohesion between the individual particles, leading to low tablet hardness.

However, brittle materials, such as **EMCOMPRESS®**, prove very beneficial if lubrication sensitivity is an issue. During lubrication their particle surfaces are covered with lubricant particles. During compression, however, the excipient particles are broken into many smaller particles with a huge number of new surfaces which are not covered by any lubricant. These surfaces free of lubricant can stick together very well and guarantee good tablet hardness – even at high lubrication concentrations.

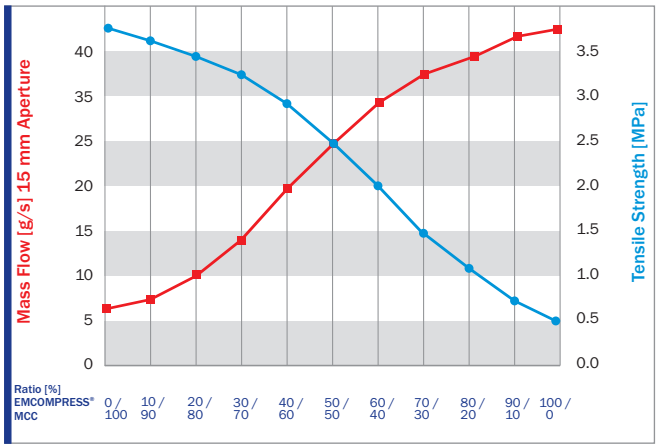


Pic. 2 Reduced Lubricant Sensitivity with **EMCOMPRESS®**. Brittle Fracture Creates Unlubricated Areas for Efficient Binding

High Density

1. Flow Improvement

EMCOMPRESS® DC grades improve powder flow due to their high bulk density, while microcrystalline cellulose exhibits outstanding compactibility. Using a combination of **EMCOMPRESS® DC** grades and microcrystalline cellulose, flowability and tablet hardness can be adjusted to formulation needs.



Graph 2 Influence of Different Ratios MCC / **EMCOMPRESS®** on the Mass Flow and the Tensile Strength of Placebo Tablets

2. Smaller Tablets

Due to the higher bulk and tapped density, DCP enables higher batch and tablet weight or lower batch and tablet volume, respectively.

Pic. 3 Effect of Amount of DCP on Tablet Height. Note: All Tablets Have the Same Weight

Stability

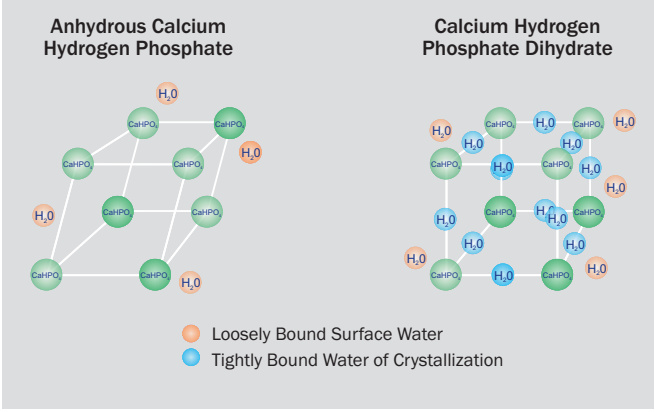
Both **EMCOMPRESS® Anhydrous** and **EMCOMPRESS®** bear loosely bound water on the particle surface which can be removed by simple heating (i.e. loss on drying; upper part of Pic. 4). The difference between the two **EMCOMPRESS®** products lies in the amount of water of crystallization. **EMCOMPRESS®** (i.e. calcium hydrogen phosphate dihydrate) comprises water of crystallization, which is incorporated into the crystal structure.

In contrast, **EMCOMPRESS® Anhydrous** is free of any water of crystallization.

Water of crystallization is tightly bound in the DCP crystal lattice and cannot be removed easily. Nevertheless, elevated temperature and humidity may occasionally trigger the liberation of the water of crystallization.

This unbound water is freely available for side reactions and can accelerate microbial growth and cause changes in powder flowability.

In order to always be on the safe side, it is advisable to use **EMCOMPRESS® Anhydrous** for new developments. Anhydrous DCP is free of crystal water and bears absolutely no stability risks, while maintaining the functional benefits of DCP dihydrate.
Likewise **EMCOMPRESS® TCP** is free of water of crystallization and therefore offers similar stability benefits.



Pic. 4 Surface Water and Water of Crystallization

Calcium Fortification

EMCOMPRESS® TCP Tribasic Calcium Phosphate is preferably used as excipient in mineral fortification health supplements since its content of calcium and phosphorus (Ca:P ratio) and its calcium load is even higher than the one of **EMCOMPRESS®** Dibasic Calcium Phosphate.

	Ca [%]	P [%]	Molar Ratio
Calcium Hydrogen Phosphate Anhydrous	29	22	1:1
Calcium Hydrogen Phosphate Dihydrate	23	18	1:1
Tricalcium Phosphate	39	20	3:2

Tab. 1 Mineral Content of Different Calcium Phosphates

Benefits of **EMCOMPRESS®**

- Enhanced flow in powder mixtures (DC grades)
- Small and dense tablets
- Robust tablets by synergistic effects with microcrystalline cellulose
- Less sensitive towards lubricants compared to plastically deforming materials
- Good performance in combination with a wide variety of APIs including sticky herbal extracts
- Acts as a pH buffer in formulations with sensitive APIs
- Perfectly suited for high-speed tableting due to low strain rate sensitivity
- Inorganic – no risk of BSE/TSE contamination and free of allergens
- High chemical stability, especially for anhydrous grades
- High supply security due to multiple production sites

Regulatory Information

- Compliant with Ph. Eur., USP, JP
- GMP certified by EXCiPACT
- GRAS listed
- Fully complies with FCC monograph on Calcium Phosphates, E 341 (ii) / E 341 (iii), Commission Directive No. 231/2015/EC and California Prop 65 due to its low content of heavy metals and aluminum
- Free of:
  - allergens
  - GMO contamination
  - BSE/TSE contamination
  - pesticides
  - irradiation
  - hormones and steroids
  - preservatives
  - organic solvents
  - gluten

Packaging, Samples and Storage

Storage
Protect from excessive heat and moisture

Packaging
25 kg paper bags available on Euro-pallets and container-pallets.
Special packaging available upon request.

Sample Size
400 g or 2 kg

JRS PHARMA

The Global Excipient Maker

Global Network

GMP Manufacturing and Service Sites

- Excipients
- Coatings
- Biopharma Services

- JRS Sales Companies (Additionally, dedicated representatives in almost every country.)
- Technical Competence Centers
- Application Labs

HIGH FUNCTIONALITY EXCIPIENTS

PROSOLV® SMCC
Silicified Microcrystalline Cellulose

PROSOLV® EASYtab SP
Microcrystalline Cellulose, Colloidal Silicon Dioxide, Sodium Starch Glycolate, Sodium Stearyl Fumarate

PROSOLV® EASYtab NUTRA
All-in-one Composite for Nutraceutical Applications

PROSOLV® ODT G2
Microcrystalline Cellulose, Colloidal Silicon Dioxide, Mannitol, Fructose, Crospovidone

DISINTEGRANTS

VIVASTAR®, EXPLOTAB®
Sodium Starch Glycolate, Sodium Carboxymethyl Starch

VIVASOL®
Croscarmellose Sodium

EMCOSOY®
Soy Polysaccharides

VIVAPHARM® Crospovidone
Polyvinylpyrrolidone, crosslinked

COATINGS

VIVACOAT®
Ready-to-Use Coating System

VIVACOAT® protect
Ready-to-Use High Functional Coating System

VIVAPHARM® HPMC
Hypromellose

VIVAPHARM® PVA
Polyvinyl Alcohol

BINDERS

VIVAPUR®, EMCOCEL®
Microcrystalline Cellulose

EMDEX®
Dextrates

VIVAPHARM® Povidones
Povidone and Copovidone

LUBRICANTS

PRUV®
Sodium Stearyl Fumarate

LUBRITAB®
Hydrogenated Vegetable Oil, Hydrogenated Oil

LUBRI-PREZ™
Magnesium Stearate

CARRIERS

VIVAPUR® MCC SPHERES
Microcrystalline Cellulose Pellets

VIVAPHARM® Sugar Spheres
Sugar Pellets, Non-GMO

FUNCTIONAL FILLERS

ARBOCEL®
Powdered Cellulose

EMCOMPRESS®
Calcium Phosphates

COMPACTROL®
Calcium Sulfate Dihydrate

THICKENERS • STABILIZERS • GELLING AGENTS

VIVAPUR® MCG
Microcrystalline Cellulose and Carboxymethylcellulose Sodium

VIVAPHARM® Alginates
Calcium Alginate

VIVAPHARM® Alginates
Sodium Alginate

VIVAPHARM® Alginates
Alginic Acid

VIVAPHARM® Pectins

BIOPHARMA SERVICES

CELONIC BEYOND BIOMANUFACTURING

ProJect Pharmaceutics

Members of the JRS PHARMA Family

JRS PHARMA *The Global Excipient Maker* JRS FAMILY A Member of the JRS Group

www.jrspharma.com

JRS PHARMA GMBH & CO. KG
Business Unit Excipients
73494 Rosenberg (Germany)
Phone: +49 7967 152-312
ExcipientsService@JRSPharma.de

5150_GB_V8_0.52008KE