Divergan® RS

White, hygroscopic powder

Chemical name(s) of active ingredient

Polyvinylpolypyrrolidone (PVPP)

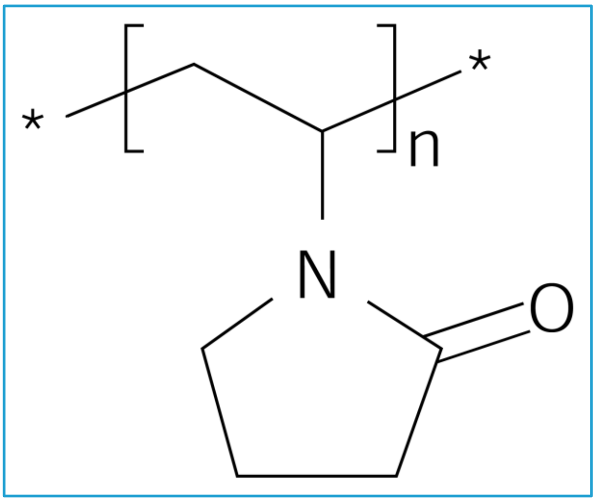
CAS-No.	9003-39-8* 25249-54-1* *country specific
EINECS-No.	n.a.

PRD

30034968

Articles

50116236	20 kg cardboard drum
50545290	0.5 kg plastic bottle



$(C_6H_9NO)_n$

PVPP can be used as a processing aid (filtration) in beverage application in most countries. It is the obligation of the user to check the regulations on the ingredients used in the respective countries and for the intended use.

Description

White, hygroscopic powder with a faint characteristic odor. Divergan® RS is cross-linked polyvinyl pyrrolidone (PVPP) that has been manufactured by means of a patented polymerization process (DP 2437629).

Benefits

Vegetarian, kosher, halal, allergen-free, gluten-free

Composition

Polyvinylpolypyrrolidone (PVPP)

Solubility

Divergan® RS is insoluble in water and all usual organic solvents. Therefore, no molar mass can be determined.

Regulations

For quality documentation please see „Quality and Regulatory Product Information" (QRPI, Quality Documentation). Divergan® RS meets the specifications of the following monographs: "Crospovidone" of FCC (Food Chemical Codex) and "E 1202" of the EU regulation laying down specifications for food additives (EU Reg. 231/2012). For further information see "Product Specification" (not for regulatory purposes) available in BASF's Human Nutrition Virtual Assistants (https://nutritionvirtualassistants.basf.com).

Stability and storage

Divergan® RS should be kept in a dry place in its tightly closed packaging. Stored in its unopened, original packaging at max. 30 °C, the product is stable for at least 36 months.

Handling

For easier removal of the bag, we recommend placing the container horizontally.

Applications

Divergan® RS is predominantly used for polyphenol reduction in beer. It is intended for re-use.

Suitability of these applications is presented based solely on technical feasibility. Local prevailing legal or regulatory requirements are not considered and should be observed separately. For further information, please refer to the attached document "*Application guidance*".

Disposal

The disposal of Divergan® RS should follow country-specific regulations and requirements.

Note

The product must be handled in accordance with the Safety Data Sheet.

Application guidance

Divergan® RS PRD: 30034968

Manufacturing site: BASF SE, Ludwigshafen, Germany

Divergan® RS (polyvinylpolypyrrolidone, PVPP) is predominantly used for polyphenol reduction in beer. It is intended for repeated use.

Function

Polyphenols are present in many fruits, such as grapes, apples, but also largely in malt and hop.

Excess of polyphenols can negatively impair the quality of beverages. Due to its specific structure and formation of hydrogen bonds Divergan® RS can selectively bind and remove polyphenols (Figure 1).

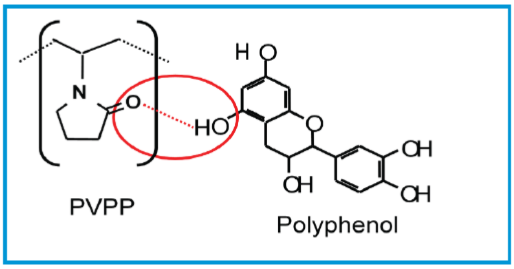


Figure 1: Principle of interactions between vinylpyrrolidone units and polyphenols

Beer:

Haze in beer after filtration is mainly caused by the formation of polyphenol-protein complexes over time. With Divergan® RS the risk of haze formation can be significantly reduced, as it is able to selectively remove polyphenols by adsorption. In this way Divergan® RS considerably improves the colloidal stability of beer. Additionally, it is known that a reduction of excess polyphenols leads to an improvement of flavor and taste profile.

Application

Divergan® RS is intended for re-use. It therefore requires special filtration and regeneration equipment consisting of a dosing device and a filter unit installed downstream of the kieselguhr filters.

Beer:

The preferred method of introducing Divergan® RS is to add it continuously and under constant stirring into the beer stream with a dosing pump. The PVPP loaded with polyphenols is filtered off after at least 3 minutes.

In some breweries, silica gel is used additionally. Here the silica gel must be dosed upfront in the diatomaceous earth/kieselguhr unit or before the membrane filtration. This results in a highly efficient combination of filtration and stabilization effects. (Figure 1)

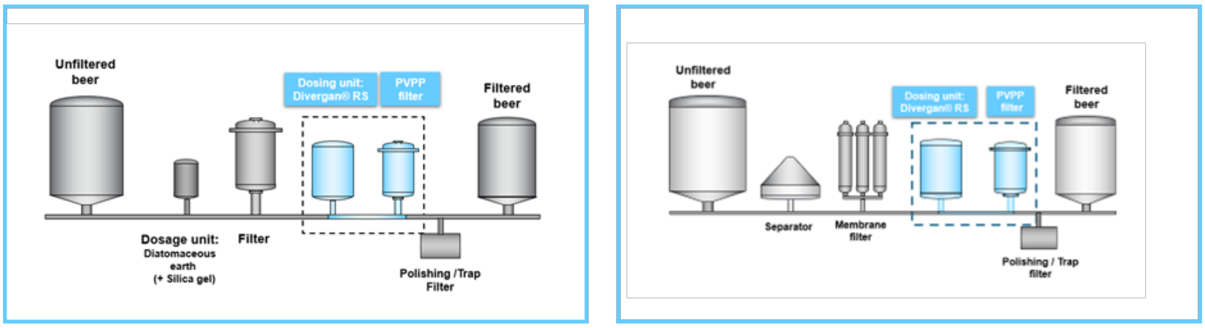


Figure 2: Possible set up options for the use of Divergan® RS for beer stabilization.

Preparation and conditioning

Divergan® RS is suspended in water (typically 10 %) under continuous stirring in the dosing unit. If larger quantities of fresh Divergan® RS need to be introduced into the system, e. g. a complete filling or a replenishment of major losses, the fresh material should be subjected to a conditioning process prior to use.

<u>Conditioning of the 1st filling with Divergan® RS</u>

- Prepare an aqueous slurry of fresh Divergan® RS (10% by weight) in dosing vessel
- Stir for 2 – 4 h (swelling time)
- Stop stirring (2-3 h sedimentation time)
- Remove max. 30% of the supernatant phase containing the fines with a narrow flexible tube = “siphoning”(Figure 2)
- Add water
- Re-plenish possible losses of Divergan® RS
- End of conditioning and start of the process.

Application guidance

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Decantation in application

Maintenance (recommended twice a year)

- Stir the existing Divergan® RS suspension in the dosing vessel
- Stop stirring and wait for sedimentation and phase separation (2-3,5 h)
- Remove max. 30% of the supernatant phase via siphoning (45 mm flexible tube)
- Add water until dosing vessel is full
- Adjust Divergan® RS concentration (recommendation 6 to 10%)
- Perform regeneration according to the filter supplier's guidelines

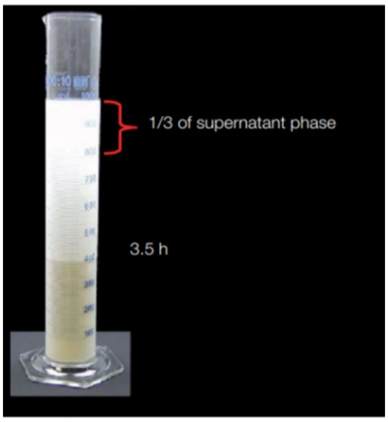

Figure 2: Phase separation: Fines located in the supernatant phase

Corrective measure (in case of increasing pressure and/or blocking of filter elements)

- Stir the existing Divergan® RS suspension in the dosing vessel and take a sample from the PVPP suspension from the middle of the dosing vessel into a narrow-necked 1-liter bottle or a glass cylinder (Figure 2).
- Note time until phase separation is completed (will depend on the PVPP concentration and the fines)
- Homogenize again the suspension in the dosing vessel
- Stop stirring the suspension in the dosing vessel, wait for sedimentation and phase separation (time will depend on the observation in the glass cylinder, usually < 3.5 hours)
- Remove the supernatant phase (30-50%, dependent from the amount of fines) by siphoning
- Add water until dosing vessel is full
- Adjust Divergan® RS concentration (recommendation 6 to 10%)
- Perform regeneration according to the filter supplier's guidelines

Losses

	Decanting	Continuous application
Typical losses	< 5 %	0,3 – 1,0 %

Table 2: Typical losses of PVPP during conditioning and use

Application guidance

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Continuous dosing

After the beer stream has been filtered through kieselguhr/membrane and clarified, the Divergan® RS suspension is continuously added via the dosing pump. The PVPP loaded with polyphenols is removed after a contact time of at least 3 minutes. The contact time is dictated by the design of the filter.

Regeneration

When the filtration and stabilization process is completed, the filter is either blown out or the beer is displaced with water. The PVPP filter cake is washed with 1 – 2% caustic soda at 80 – 85 °C. The different filter manufacturers recommend either a one alkali- or a two-alkali process. The alkali treatment converts the adsorbed polyphenols into water-soluble anions that can be washed out of the filter cake as a dark-colored solution. Often, the PVPP also gradually turns brown with use, but this does not detract from its effectiveness.

After it has been regenerated, the filter cake is washed with hot water (50 – 70 °C) to remove the remaining polyphenols and alkali. It is then neutralized with a diluted mineral acid e. g. 0.5% nitric acid or 1% phosphoric acid. The filter is then blown out with CO_2 and the filter cake is removed while still moist (classical precoat filtration). Horizontal filters can be spun to remove the filter cake. The PVPP is then returned to the metering dosing vessel and any losses are made up. It is essential to follow the recommendations of the filter manufacturer throughout the filtration/stabilization process to avoid damage to the equipment.

Dosage

The optimum dosage rate depends on many factors. A major factor is the stability to be achieved – shelf lives of more than 12 months are possible. Other factors include the raw materials used, the cellar equipment, the degree of clarification prior to filtration, and the type and quantity of other stabilizing auxiliaries used.

Application guidance

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Malt content	Divergan® RS	Combination Divergan® RS & kieselguhr
100 % malt	20-50 g/hl	15-40 g/hl
Malt & adjuncts (ca. 30%)	15-35 g/hl	10-30 g/hl

Table 2: Addition rates for Divergan® RS for different types of beer.

In case of further questions or need of support please contact your local BASF representative.