

## Hand Sanitizer Gel using Tylopur<sup>®</sup> DG-4T

### Introduction

Hand sanitizer gel is a hydroalcoholic gel formulated with a high level of alcohol. The Center for disease control and prevention (CDC) recommends a minimum of 60 percent alcohol for an alcohol-based hand sanitizer.[1] The formulation of hand sanitizer gels use polymers as thickener agents to increase the viscosity of the gel. Shin-Etsu HPMC TYLOPUR<sup>®</sup> DG-4T (Hypromellose 2910) is a suitable thickener for this application due to the stability in and compatibility with organic solvents.

### Compatibility of TYLOPUR<sup>®</sup> DG-4T with Alcohol

Method for dissolution of HPMC in water/alcohol mixtures:

1. Place ethanol or isopropanol in a beaker and slowly add HPMC powder while stirring with mixer or similar.
2. Continue stirring until a homogenous suspension is observed.
3. Slowly add cold water to dissolve.

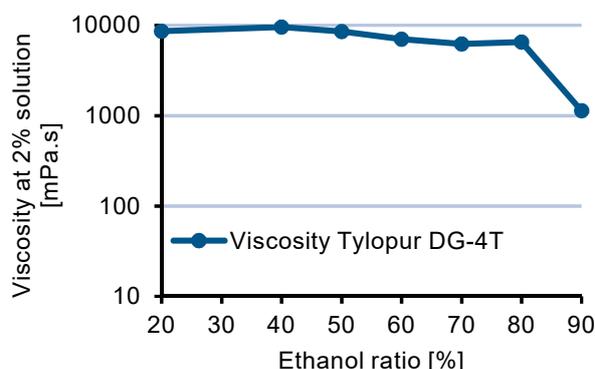


Figure 1: Viscosity of TYLOPUR<sup>®</sup> DG-4T for different ratios of water/ethanol mixtures. Viscosity of 2 % solution was measured with a Brookfield type viscometer at 20 °C.

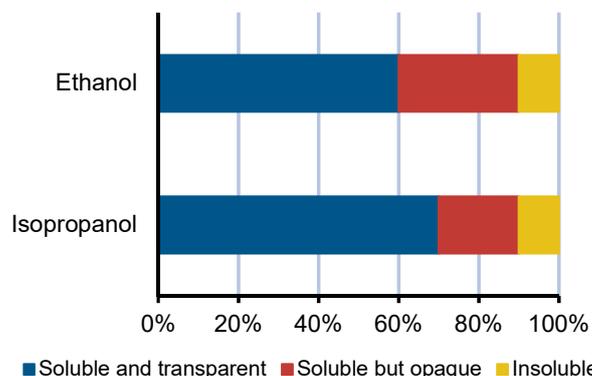


Figure 2: Solubility of HPMC 2910 for different ratios of ethanol and isopropanol.

HPMC has a good solubility in alcohol, HPMC 2910 showed a good solubility for higher percentages of ethanol and Isopropanol (figure 2). Figure 3 shows that a 2 % solution Tylopur<sup>®</sup> DG-4T is visually transparent until a maximum of 70 % of ethanol.

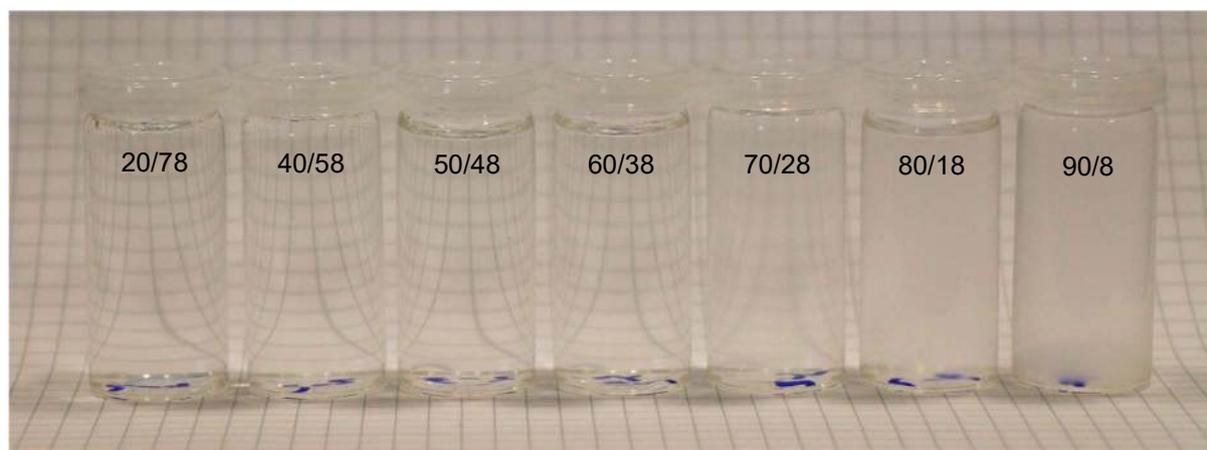


Figure 3: Solution of 2 % TYLOPUR<sup>®</sup> DG-4T with different ratios of ethanol/water mixtures.

## Example Formulations

A hand sanitizer gel should be composed by less than 40 % of water and more than 60 % of alcohol. The composition also needs a thickener agent (e.g. HPMC) and a humectant (e.g. glycerine, propylene glycol). Additionally, a chelating agent can be used, such as tetra sodium EDTA or sodium citrate. Fragrances and extracts can also be added to the gel. A neutralizing agent, such as sodium hydroxide, can be used to achieve the desired pH.

Table 2: Hydroalcoholic gel formulation with TYLOPUR® DG-4T.

Material	Formulation 1 [%]	Formulation 2 [%]	Formulation 3 [%]	Formulation 4 [%]
Water	33.0	23.0	13.0	25.0
TYLOPUR® DG-4T	2.0	2.0	2.0	2.0
Ethanol 99.5%	62.0	72.0	82.0	-
Isopropyl alcohol	-	-	-	70.0
Glyceride	3.0	3.0	3.0	3.0
<b>Gel Properties</b>				
Viscosity at 25°C [mPas]	7768	6184	5352	7698

\*Viscosity was measured with Brookfield LV viscometer at 25 °C.

Formulation:

1. Mix HPMC with glycerine and alcohol (ethanol or isopropyl alcohol) – phase A.
2. Slowly, add water to phase A. Stir for 10 minutes until a transparent gel is formed.

For formulations with more than 70 % of alcohol, the following procedure can be followed to increase the viscosity and transparency of the solutions.

1. Mix TYLOPUR® DG-4T with glycerine and 10-20% of the total amount of alcohol (ethanol or isopropyl alcohol) – phase A.
2. Slowly, add water to phase A and stir until TYLOPUR DG-4T is completely dissolved.
3. Add the rest of alcohol. Stir until a transparent gel is formed.

## Summary

Hand Sanitizer gel was successfully prepared with Tylopur® DG-4T with ethanol and isopropyl alcohol. A solution of HPMC Tylopur® DG-4T (2 wt%) shows good solubility and transparency until 70 % of ethanol and isopropyl alcohol.

Hand sanitizers gels are alcohol based products, therefore they are potentially flammable. Fire hazard potential should be considered and steps should be taken to minimize risks during the handling and storing of these products.



## References

- [1] <https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html>

Note: All of the data presented here are accurate and reliable to the best of our knowledge, but they are intended only to provide recommendations or suggestions without guarantee or warranty. All of our products are sold based on the understanding that buyers themselves will test our products to determine their suitability for particular applications. Buyers should also ensure that use of any product according to these data, recommendations or suggestions does not infringe any patent, as Shin-Etsu will not accept liability for such infringement.