

observed using any amount of propylene glycol as the solvent. The higher than baseline side products consisted mainly of lactate, formate, ethanol, and propanol. Again, ethylene glycol selectivity was lower than baseline, but not enough to have a major impact on downstream separations.

For test runs F169-9 and F169-10, the flow rate of feed was dropped to about 25 ml/hr. This resulted in a negligible glycerol conversion increase and an eventual drop in propylene glycol selectivity down to about 71%. It should be noted that a flow rate of about 25 ml/hr has historically been difficult for a 30 cc reactor to maintain consistent results due to expected channeling at such low flow rates. This is most likely exacerbated by the use of a higher viscosity feed.

Given the results from test run F169-8, where the temperature of the reactor was at 170° C. down from the baseline case of 190° C., the propylene glycol selectivity was 88% versus the baseline of 93%. It is anticipated that this could be further improved by one of skill in the art with some process tuning. However, the glycerol conversion drop from the baseline of 76% down to 48% represents a significant change. As such, the reactor bed would have to be much larger, incurring equipment and catalyst costs, but this would need to be compared against the impact on the downstream separations given that the amount of water sent to separations is greatly reduced by nearly an order of magnitude.

It should be appreciated that the disclosed processes and systems could be optimized with respect to the baseline by one of skill in the art by varying the process parameters and/or by using better performing catalysts. For instance, the process can be carried out at temperatures from about 160° C. to about 240° C., and at pressures from about 400 psi to about 1600 psi. Catalysts disclosed in U.S. Pat. No. 6,841,085, and co-pending U.S. patent application Ser. No. 12/711,020, entitled, "Catalysts And Processes For The Hydrogenolysis Of Glycerol And Other Organic Compounds For Producing Polyols And Propylene Glycol," filed on Feb. 23, 2010, and incorporated herein by reference, are believed to be suitable for the process and system disclosed herein.

The product recycle processes and systems disclosed herein will reduce energy and resource requirements and costs by eliminating the addition and removal of water solvent as a result of the recycling of hot reactor effluent into the glycerol feed, while at the same time not significantly impacting the amount of propylene glycol produced.

Additionally, other aqueous catalytic processes could also benefit from the disclosed processes and systems, particularly technologies that produce a solvent as a product and require a more dilute feed.

In view of the many possible embodiments to which the principles of the disclosed processes and systems may be applied, it should be recognized that the illustrated embodiments are only preferred examples of the invention and should not be taken as limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims. We therefore claim as our invention all that comes within the scope and spirit of these claims.

We claim:

1. A process for producing propylene glycol, comprising: combining a solvent comprising propylene glycol with a feed comprising glycerol to provide a diluted glycerol feed; reacting said diluted glycerol feed with a catalyst in the presence of a soluble base to convert the glycerol to a product comprising propylene glycol; recycling back into the process at least a portion of propylene glycol product as a solvent for the glycerol feed; and wherein at least a portion of the soluble base is also recycled back into the process along with at least a portion of the product comprising propylene glycol as a solvent for the glycerol feed.
2. The process of claim 1 wherein the soluble base is sodium hydroxide.
3. The process of claim 1 wherein the diluted glycerol feed comprises about 1% by weight soluble base.
4. The process of claim 1 wherein the base is sodium hydroxide.
5. The process of claim 1 wherein from up to about 60% of the product is recycled back.
6. The process of claim 1 wherein the diluted glycerol feed comprises from about 40% to 60% by weight glycerol.
7. The process of claim 1 wherein the diluted glycerol feed comprises from about 40% to 60% by weight propylene glycol.
8. The process of claim 1 wherein reacting said diluted glycerol feed with a catalyst results in about 70% or greater selectivity to propylene glycol.
9. The process of claim 1 wherein the diluted glycerol feed comprises less than about 12% water by weight.

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