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USING PL-20H AS AN EMULSIFIER

BENEFITS OF USING EGG LECITHIN

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Executive Summary

Ecovatec's revolutionary technology has unlocked the amazing potential of Egg Phospholipids. Phospholipids make up most of the cell membranes in our bodies, holding and sustaining the protein molecules through which cells communicate via hormones and neurotransmitters. Healthy membranes allow our cells to remain "fluid" and flexible and thereby function properly. Healthy membranes make for healthy cells.

Phospholipid (PL) products are often called lecithin, especially when in concentrations of about 20-30% phospholipids. Lecithin is used as an emulsifier in food and cosmetic products and is usually derived from soybeans. Other egg-emulsification products are enzyme modified egg yolk or solvent-extracted egg PL. However, there are significant problems with these products.

Ecovatec's PL-20H (hydrolyzed phospholipids) is a superior emulsifier: it dissolves immediately in water, does not allow for oil and water separation in emulsions, only requires a small quantity (so doesn't affect the taste of the product), and does not require any heat to incorporate it into a mixture. It is also made without any of the harsh solvents used by other egg PL manufacturers and unlike other enzyme modified egg products, our enzymes don't increase the amount of carcinogenic lysophosphatidic acid (LPA). Also, unlike most soy lecithin, egg lecithin is GMO free.

In addition to its emulsification properties, egg phospholipids have been shown to have the following **health benefits**: **anti-inflammatory** and **cancer-fighting** properties, improved **cardiovascular** health, **neurological** performance (including nerve function, learning, and memory), and **liver** function. To learn more about the wonderful health benefits of egg phospholipids, read our *Phospholipids Health Benefits white paper.*

In this paper, we will go into more detail about why egg phospholipids (lecithin) should be used as an emulsifier in the food industry.

Background

Phospholipids are a major component of all cell membranes. Their unique structure makes them useful in water and fat/oil solutions and they are frequently used as emulsifiers (prevent oil and water separation). Phospholipid products are usually called lecithin and have a variety of commercial uses including pharmaceutical, cosmetic, dietic, and emulsification.

In the food industry, emulsifiers generally need the following characteristics:

- No strong smell or taste
- Able to keep oil and water mixed in solution
- Can dissolve easily into the emulsion
- Shows high heat stability (keeps emulsion mixed at high heat)
- Has no negative health concerns with use
- Small Amounts Needed

Comparing Emulsifiers

Ecovatec partnered with an external research facility to review the emulsifier properties of several commercially available lecithins. The testing and results are described in the "Testing Emulsifiers" section. Here we present a summary of the findings.

Product	Smell/Taste/ Color	Oil Retention in Experiment	Dissolves Easily	High Heat Stability	Health Concerns	Small Amounts
EcovaPure™ PL-20 (unhydrolyzed egg yolk lecithin)	Light Color	99%	Yes	Yes	Health benefits; Non-GMO	Yes
EcovaPure™ PL-20H (hydrolyzed)	Light Color	100%	Yes	Yes	Health benefits; Non-GMO	Yes
PL30J (solvent extracted egg yolk lecithin from another company)	Dark Color	<50%		?	Use harsh solvent	No
PL30C (solvent extracted egg yolk lecithin from another company)	Light Color	<50%		?	Use harsh solvent	No
Magic Flavors™, Egg Yolk Powder	Unpleasant Taste/Light Color	52%		Yes	High in LPA - Carcinogen	Yes
Soy Lecithin Powder (SLP)	Unpleasant Taste/ has to be bleached for light color	<50%	No	No	Often GMO; Use harsh solvent	No

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Commercial Cost and Safety of Lecithin Products

Enzyme modified egg yolk (like Magic Flavors™) is becoming more popular in many products as a lecithin. It is comparable in cost to PL-20H although is not as good as an emulsifier. The enzyme used to modify the egg yolk is called "Phospholipase A2" and this **generates pro-inflammatory lysophosphatidic acid** in the product[1]. However, this acid has been shown to play a causative role in **neurotrauma**[2], supports the growth and spread of **colorectal cancer**[3], and has a detrimental effect on the cardiovascular system through **atherosclerosis**[4]. The widespread use of phospholipase-modified egg yolk powders is extremely concerning to consumer health. Therefore **PL-20H** is not only a **cost-effective replacement** for the use of this product in food products, but it may have public health benefits. Phospholipase modified egg yolk is also found to have a distinct negative off taste imparting an unwanted flavor to the finished product it is used in.

Soy lecithin powder, while a worse emulsifier, is about 50x cheaper than egg yolk lecithin and is widely used in products where cost-effectiveness is important. However, in health products, companies could consider using the more expensive PL-20H to make additional health claims about their product, given the numerous health benefits of egg yolk phospholipids.

Testing Emulsifiers

Ecovatec's *EcovaPure™* PL-20H product is a partially hydrolyzed version of lecithin, which contains a minimum of 20% egg yolk derived phospholipids. This product was tested in an external lab[1] and compared to several other emulsifiers to test its ability to keep oil and water together in solution.

The products tested were as follows:

- *EcovaPure*™ PL-20 (unhydrolyzed egg yolk lecithin),
- *EcovaPure*™ PL-20H (described above),
- PL30J and PL 30C (solvent extracted, 30% phospholipid egg yolk products from two different processors),
- Magic Flavors™, Egg Yolk Powder (MFEYP, enzyme modified egg yolk), and
- Soy Lecithin Powder (SLP).

Emulsions were prepared with 79.0% vegetable oil, 10.1% water, 7.3% white vinegar, 1.8% emulsifier, and 1.3% salt using a food processor and tested for heat stability using convective and radiation heat transfer. Viscosity, color, acetone insoluble, acid value, peroxide value, droplet sizes, and stability were analyzed.

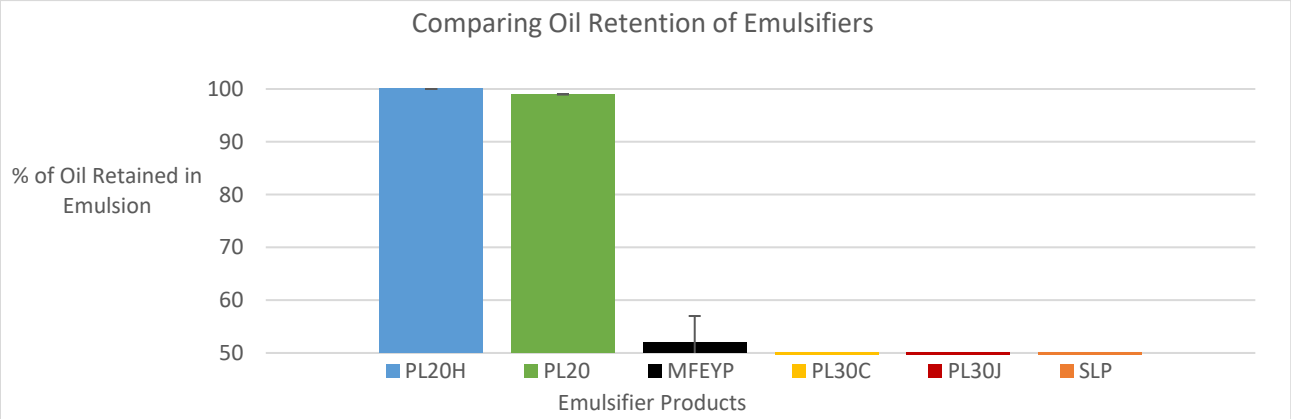

Figure 1. Products were compared on their their ability to act as emulsifiers. The % of oil that was retained in the emulsion at the end of the trial was measured and is shown above. Values not shown for products that showed <50% oil retention

Figure 1 above clearly shows **that *EcovaPure*™ PL-20H** was the **best emulsifier** tested with 0% oil separation. In comparison, soy lecithin showed the **most oil separation** than any other product tested, and yet is used as the main emulsifier in most foods.

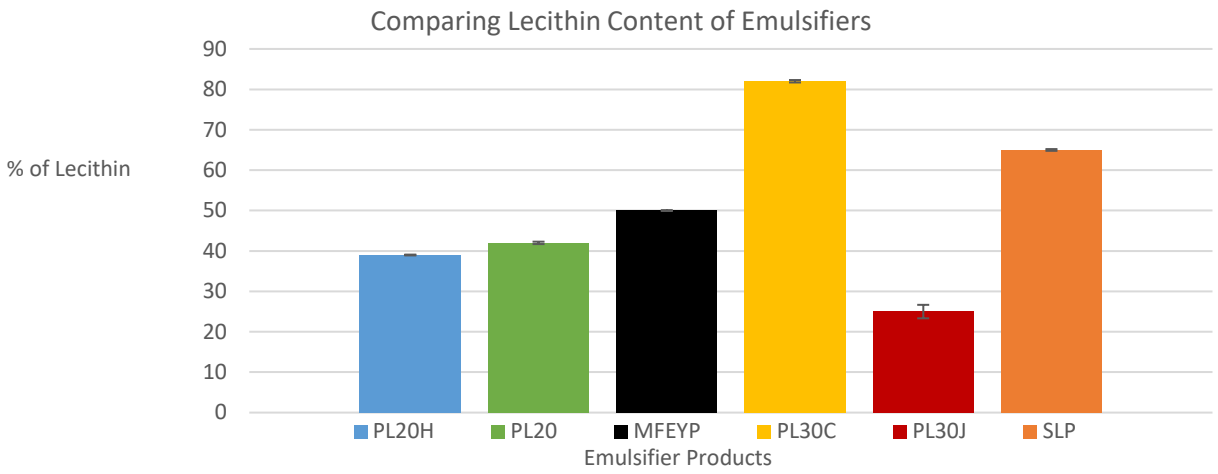

Figure 2. The lecithin conent of the products tested as emulsifiers.

The lecithin content of the tested emulsifiers is shown above. Note that with average lecithin content, ***EcovaPure*™ PL20H and PL20** had the best emulsification properties while soy lecithin and PL30C had high lecithin contents with poor emulsification results. This shows that a little goes a long way with PL-20H.

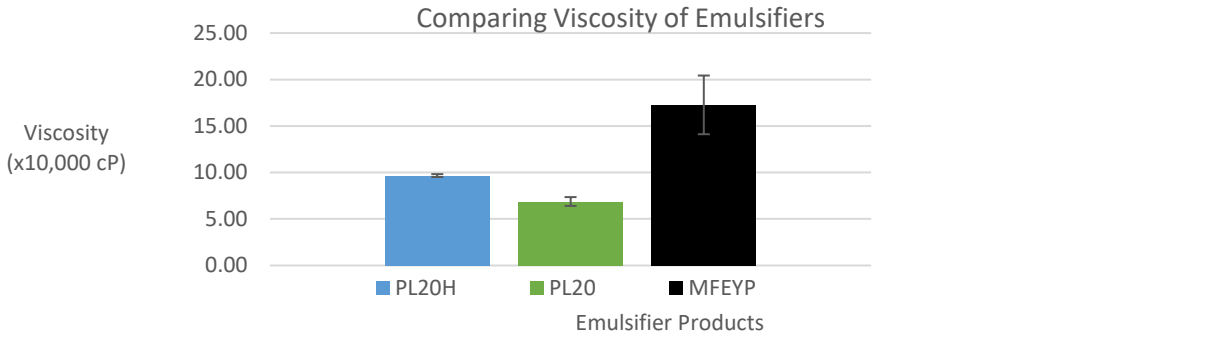

Figure 3. The viscosity of the emulsification solutions that held up in Figure 1 are shown above. **Lower viscosity is better** in the emulsification solutions.

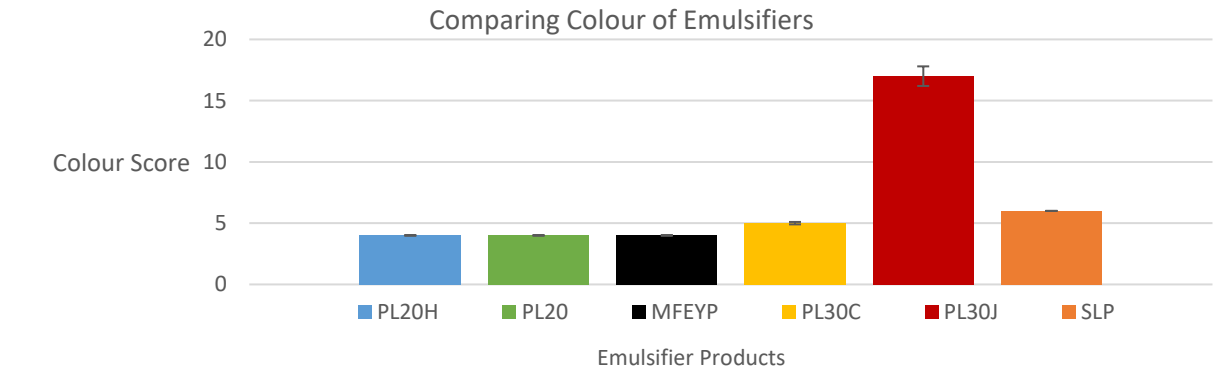

Figure 4. The colour score of each emulsifier is shown above, where a **lower score indicates a better, lighter colour.**

Figures 3 and 4 illustrate that **PL-20H** not only has the ideal low viscosity required of an emulsifier, but it also has a better color score than other traditional emulsifiers such as soy lecithin.

PL-20H is also fully soluble in water, so products do not need any heating to incorporate it into the food mixture.

Conclusion

Based on the experimental results shown above, egg phospholipids are not only an excellent emulsifier, they exhibit the best emulsifier properties for food products, such as low viscosity, light color, and require only a small amount of lecithin to meet the emulsification needs. Ecovatec Solutions Inc. is partnering with the Manitoba Food Development Centre and the National Research Council of Canada to perform further studies to test *EcovaPure™* PL-20H as a food ingredient.

Sources

[1]Losso, Jack. *Abstract- Comparison of rheological, physicochemical, and microstructural properties of egg yolk containing higher ratio of phospholipids and phospholipase A2 modified egg yolk.* Louisiana State University, 2017.

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