

Chemistry of Mayonnaise



Two of mayonnaise's main ingredients--- vinegar and oil--- do not mix. Vinegar consists of polar molecules, namely water and acetic acid. The intermolecular attractions between these are strong because there is an attraction between the negative acetate ion and water's hydrogen atoms and also between the oxygen atom in water and the positive H^+ ions in acid.

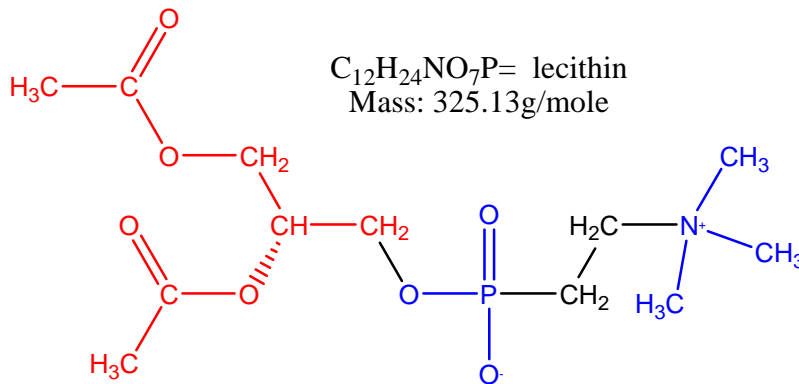
Oil molecules are attracted to themselves. In fact there could be intermolecular attractions between water and oil, but compared to the previously mentioned bonds, the water-oil ones are very weak. For this reason the oil

and vinegar stick with their own kind.

Water or polar like attractions >> oil-oil attractions >> oil-water attractions

So how do we get them to mix?

Well we need a molecule that could get along with everyone and form strong bonds--- something that will grab the watery, vinegary molecules with "one hand" and the oil with the other. And that molecule is **lecithin** found in the egg yolks. The ionic part (in blue) on the right is the part that interacts with the vinegary portion, and the part in red strongly attracts oil.



So here's the simplified recipe:

125 ml of corn oil
15 ml of white vinegar or lemon juice
1 teaspoon of salt
1 egg yolk



From a former student (Andrew Liberio) now attending a culinary institute.

First you have to properly beat or whisk all the ingredients except for the oil. Then, most importantly, the oil has to be added literally drop by drop for the first 3 tablespoons at least. This is what gives the mayonnaise the thick consistency. If you add too much oil at once, or just mix all the ingredients at once, the sauce "splits" as we call it in cooking school, what happens is that the oil separates from the rest of the ingredients and you can beat or whisk that mixture for hours, it will never develop the thick consistency of mayonnaise, the only way to fix a broken sauce is to put a tablespoon of water into a separate bowl and pretend that the water is the new egg, salt and vinegar mixture, and that the split sauce is the oil. Drop by drop add the split sauce to the water and you'll get your mayonnaise back.

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