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**Displacing Palm with High Oleic Soybean Oil - Utilizing High Oleic Soybean Oil for Instant Noodles (Ramen)**

Hello everyone, thank you for inviting me to speak at your conference. I wish you good day.

Today we are going to look at the use of high oleic soybean oil to replace palm oil for the frying of instant noodles.

So what are noodles? Noodles are one of the most stable foods, rightly consumed in Asian Countries but it has gained acceptance worldview.

Is is available in raw, uncooked, partially cooked or cook form. Most population type is instant noodle, or ramen as you call it in North Asia.

So ramen or instant noodle are made from wheat flour, starch, water, salt, or kansui, which is an alkaline salt mixture of sodium carbonate, potassium carbonate, as well as sodium phosphate and other ingredients that improve the texture and flavor of the noodles.

These ingredients are mixed to form a dough which is then sheeted followed by a cutting process into noodle strands. These noodle strands are then partially cooked by steaming, cut and formed into a two layered noodle cake before undergoing a deep frying process.

Instant noodles, or ramen, have gained popularity due to its taste, convenience, long shelf-life and reasonable pricing.

Now this, uh, chart shows roughly how the instant noodles are made. So basically you have a roller that shoots it and then roller that cuts it and then you steam it and then it is fried and the noodles come up from the frying chamber. So this basically the process for making ramen or instant noodle.

The global demand of instant noodle is very large in the year 2018, 103.6 billion servings it was annually to consumers throughout the world. And the demand is rising as you can see. So on average, about 280 million serving are consumed daily.

Now you might think that most of this consumption, consumption of instant, instant noodle or ramen is in Asia. Well to a certain extent you're right but you can see that the U.S.A is the six largest consumer. And you look at Brazil, Russia they are also significant, Mexico, consumers.

So basically in China, uh, you have 40 million servings, uh, and the total value of the instant noodle worldwide is about 42.2 billion U.S dollar. So this is a substantial market, obviously.

So what are the criteria for the selection of frying oil for instant noodles? Well, since instant noodle is actually fried it contains about 15-20% oil. The oil quality is one of the major determinants of flavor and shelf life in instant noodles and it is responsible for imparting an instinct note to the noodles.

Therefore, the oil used for the frying medium of the instant noodles must be of good quality that can impart a long shelf life with good flavors in order to fulfill the requirements of a good instant noodle.

The minimum shelf life requirement for instant noodle is about one year.

Now beginning the selection of frying oil, um, the degree of unsaturation is important. Oils with higher levels of polyunsaturated fats are less stable than oils with higher levels of saturated fats or monounsaturated oleic acid.

During frying, the quality of the oil deteriorates as a result of oxidation from prolonged and continuous heating, triggering food safety concerns and sensory problems.

Therefore, flavor and oxidative stability are the major concerns in the selection of oils used for frying.

The quality of the frying oil can be predetermined by their physical and chemical properties such as iodine value, peroxide value, free fatty acid and smoke point or through subjective measurements such as the visual appearance of the oil, for example, color or the organoleptic properties like odor and flavor.

So we have palm oil, what is palm oil. Well, palm oil is almost used exclusively in the frying of instant noodles because of its good frying performance and oxidative stability, and availability and relatively low cost.

In general instant noodle fried in palm oil has a shelf life of a minimum of 1.5 years.

However, it has a distinctive palm oil odor and flavor, which some people don't like. And there are some food safety concerns regarding high levels of carcinogens 3-MCPD and glycidyl esters.

So what are soft oils, soft oils are oils like soybean oil, canola oil, sunflower oil, corn oil, etc.

They have high levels of polyunsaturated fats and therefore have lower oxidative stability. They be, they are easier oxidized and can become rancid producing products with shorter shelf lives.

Generally they cannot be used for frying of instant noodles as the shelf life of instant noodles, fried in soft oils will be less than 6 months.

This is the test we did in our lab, uh, frying instant noodles in sunflower oil. Now basically on the vertical axis is the number of frying cycles. On the horizontal axis is the number of, uh, days of incubation at 65 degrees C. This is a standard test for shelf life, uh, one day incubation at 65 degrees C is equivalent to one month at ambient temperature.

So from this results you can see that within two days, or three days of incubating at 65 degrees the sunflower oil fried noodles were already slightly rancid and by the fifth day it was rancid. So obviously the maximum shelf life you can have for such a noodle is less than six months.

Okay now we address the issue about public perspective of instant noodle. Many believe perceive instant noodle, noodle, especially fried in palm oil as an unhealthy food from the oil perspective.

Why is that so? Because it is high in saturated fats. Saturated fats account for 40% of total fat in the noodle. One serving of instant noodle will contribute 6.4 grams of saturated fat or 32% of your recommended daily intake of 20 grams.

There's virtually no omega 3 in palm oil and the rational of omega 3 to 6 in palm oil is 56 to 1, which obviously is not anywhere near the recommendation of less than 5 to 1.

How about high oleic soybean oil. Well, high oleic soybean oil is bland and without flavor. It has better oxidative stability, as the lower levels of polyunsaturated fats, uh, compared to the common soft oils.

It's good for health because it contains high levels of oleic acids or we call them omega 9. The FDA has approved a qualified health claim for high oleic oils.

So how does high oleic oil compare with palm oil? Well, uh, its quite obvious the saturated fats in palm oil is about 41% and in high oleic soybean oil it's 11%. The monounsaturated fats in palm oil is 47%, in high oleic soybean oil is 81%. In polyunsaturated fatty acids about 12% in palm oil and about 7% in soybean oil. And the ratio of saturated unsaturated, uh, fatty acids for palm oil is very low at 0.29 and for high oleic soybean oil is 0.62. So we would expect this oils to be very stable under frying conditions.

So you can see there, uh, the amount of omega three, six, and nine. So obviously high oleic soybean oil has very high levels of oleic acid, uh, low levels of, uh, uh, omega 6 and low levels of omega 3. While palm oil has, uh, high levels of saturated and low levels of both, uh, both omega three and six and medium level of omega 9.

Okay, now we look at our experiment. Our experiment compares the frying properties in stability of high oleic soybean oil against palm oil in instant noodle frying.

So we measure the oxi, oxidative stability index of the oils and during frying we measure the peroxide value, anisidine value, and total polar compounds. This are the normal parameters which, uh, we use to evaluate, uh, the quality of the frying oil. And thirdly we evaluate the sensory aspects of the instant noodles.

So when we measure the oxidative stability index, OSI, of the palm oil and high oleic soybean oil, we found that they were close, uh, at 19.8 for palm oil and 18.8 for high oleic soybean oil. Okay, this are actually really good results, um, most of the soft oils we looked at be below ten [inaudible 00:10:48].

This is the actual frying test we did, so we put four liter of oil into a deep fryer and we set the temperatures at 150 degrees C or 302 degrees fahrenheit. We fry 50 grams of instant noodle per batch for 70 seconds. Every 10, 20, 30, 40, 50 cycles we take out about 200 grams of frying oil, uh, and we filter it and we test for peroxide value, anisidine value, and total polar compounds. We do not replenish the oil through the frying process, which they were doing in commercial plan because this is an experiment, if we replenished the oil then obviously the results would be not same. So no replenishment of oil during the frying process of up to 50 cycles.

Well, these are the results of peroxide value. So you can see, after 50 cycles, uh, the palm oil had a peroxide value of 14.7 and the high oleic soybean oil had a peroxide value of 16.87. Now this is slightly higher then the usual maximum of 10 but we are frying for 50 cycles without [inaudible 00:11:56] without replenishment of oil. So this is to me a good result, so they are fairly close almost the same.

Next we measure the anisidine value at different frying cycles. Anisidine value is measuring the total oxidation value of the oil. Uh, because peroxide [inaudible 00:12:16] oxidation products [inaudible 00:12:18]. So we measure all the oxidative products and here we see a similar result, uh, the palm oil after 50 cycles, um, you know, had about 22 or about 23 and the high oleic soybean oil had about 27. Well, palm oil is slightly lower but if you look at result at 40 cycles not that much and at 30 cycle the high oleic, uh was, soybean oil is actually better. So it is not that far apart.

Than this is the result which was to palm oil significant this is the total polar compounds of the palm oil and the high oleic soybean oil during the drying process at 150 degrees C. So what you see here is that, uh, high oleic soybean oil started at a much lower level of total polar compounds at around 3 as opposed to 7 but as the number of frying cycles increased the amount of total compounds of high oleic soybean oil only increased slightly from about 3 point, say 3.1, 3.1 to about 5. Palm oil started at 7 and increased to about 9.2. so we can see that as far as total polar compounds are concerned, uh, palm oil is not as good as high oleic soybean oil.

So if you look at, uh, the table here, normally in the frying company anything below 10 is good. And if it is above 10, um, 15 still good and once it goes to about 18, 20 they will discard it. So in this case both the palm oil and the high oleic soybean oil did manage to perform better than industrial standard. But the high oleic soybean oil was significantly better

Okay, now we compare the shelf life, the accelerated shelf life of the instant noodle fried in high oleic soybean oil and palm oil.

On the vertical axis we have the frying cycles. And on the horizontal axis we have the incubation days at 65 degrees C, okay. So the yellow color is the instant noodle fried in palm oil, okay. So after 35 days at 65 degrees C, which is equivalent to 35 months of shelf life at ambient temperature, the instant noodle fried in palm oil became rancid, uh, the number of frying cycles didn't seem to matter whether it was the first cycle or the 50th cycle all instant noodle fried in palm oil went rancid at 35 days at incubation at 65 degrees C, okay.

Look at the green numbers those are for the instant noodles fried high oleic soybean oil at the same conditions. So you see those noodles only became rancid at 50 days or equivalent at 50 months at ambient temperature. And the same results as palm oil, the number of cycles didn't make a difference to, uh, the time it went rancid, okay.

so this shows clearly that you virtually have about more than a year of shelf life advantage if you fry your instant noodles in high oleic soybean oil over palm oil.

Now next we will look at the flavors and odors caused of the instant noodle fried in palm oil and high oleic soybean oil. Same thing the vertical axis is the number of frying cycles. Horizontal axis the number os days incubation at 65 degrees C. Now look at the yellow color, um, at day one, at day ten we rate that the flavor score to be eight. Now if you look down at the bottom of the slide eight means mild, typical oil odor, no off odor, off flavor. Okay, so acceptable. Then you go to 20 days at 65 degrees, same result. 30 days you have a stronger particular oil but no off odor of flavor. Then you go to 35 days the number goes to six, which means it is rancid.

now look at the green slide at 10, cycle 10 the flavor odor was written at nine. nine means completely bland, no flavor no odor, okay. Day 20 at 65 degrees same score, nine. Day 30, eight and day 40, seven. So basically, what you have there at day 30 is about the same odor and flavor score as a palm oil at day ten. And at day 40 yeah that's obviously, uh, starting to go bad so we have a stronger typical oil odor and flavor but no off flavor odor and then 50 days it dropped to six which is rancid.

So that's interesting so basically what you have is a better product from day one and the product that lasted longer in terms of bland flavor and odor for noodles fried in noodles fried in high oleic soybean oil compared with palm oil.

Now, this is just a summary of what, uh, we were talking about, okay. So for the odor and flavor the instant noodles fried in palm oil had a distinct palm odor and flavor but those fried in high oleic soybean oil were thought to be bland. The shelf life of noodles fried in palm oil was about three years, based on the [inaudible 00:18:41] shelf life testing method at 65 degrees C.

Well, the high oleic soybean oil noodles lasted more than four years so it was more than one year difference in shelf life. Now from the nutritional, uh, side of things, uh the instant noodle fried in palm oil contributed about 6.4 grams of saturated fat per serving, 7.4 oleic acid and you had an unfavorable ratio of omega 3 to 6 or 56.1. on the other hand the instant noodle fried in high oleic soybean oil was low in saturated fats at only 1.7 grams per serving, very high in oleic acid at 12.8, and it had a good omega 3 to 6 ratio or 3 to 1.

So in conclusion, the high oleic soybean oil can be used as a replacement for palm oil in the frying of instant noodles or ramen for improving its health status, sensory properties and also shelf life.

There is a possibility of transforming public perception of instant noodle from a junk food to a healthy and nutritional food when you switch the frying medium from palm oil to high oleic soybean oil. This is because the amount of saturated fats will drop from 6.4 grams to 1.7 grams per serving a 73% reduction while oleic acid will increase from 7.4 grams to 12.8 grams per serving a 72% increase. The ratio of omega 6 to 3 will also be reduced, uh, significantly from 56 to 1 to 3 to 1.

Instant noodle fried in high oleic soybean oil is bland with a better flavor score when compared to instant noodles fried in palm oil.

And instant noodle fried in high oleic soybean oil has a significantly longer accelerated shelf life, four years compared to instant noodles fried in palm oil.

Thank you very much.