

Analytical Report on Ava Dish Soap  
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This report was requested by Jess Brandt for a product called Ava Dish Soap sold by AvaAndersonNonToxic.com. I received a box of two 16 oz bottles shipped from Ava Anderson Non Toxic, Station 112, 99 Main Street, Warren RI 02885 to a third party and forwarded to me. As far as I could tell, the box had not been opened, and the security seals on the bottles were intact.

The product is a colorless, transparent, viscous liquid with a pleasant citrus aroma. The question put to me was whether the ingredients list accurately reflects the contents of the product. The listed contents are: *cocos nucifera* (organic coconut) oil, *elaeis guineensis* (organic palm oil), *simmondsias chineses* (organic jojoba) oil, water, (filtered), *laminaria hyperborea* (organic kelp) extract, *thymus vulgaris* (organic thyme), *citrus sinensis* (organic orange essential oil), *citrus limonum* (organic lemon essential oil), *citrus nobilis* (organic mandarin essential oil), and *rosmarinus officinalis* (organic rosemary) oil.

My initial impression of this list was that with the exception of filtered water and possibly kelp extract, all of these materials are oils, and consequently insoluble in water. If the ingredients list were accurate, the product should separate on standing into an oil phase and an aqueous phase. The product I received did not do so. I concluded that the product is not a mixture of oils and water, as claimed.

The intent of the label might have been “soap made from *cocos nucifera*...” I made a 1% solution of the product in deionized water and measured the pH. Soap solutions have a pH from 8 to 10. This product has a pH of 7.09.

Soap is defined by the Food and Drug Administration as an alkali salt of a fatty acid. At low pH, all soaps convert to insoluble fatty acid. The solution should get cloudy as the fatty acid separates from the aqueous solution, and it should lose its ability to produce suds when shaken. I lowered the pH of a 1% solution of this product in deionized water by adding one drop of concentrated hydrochloric acid. The resulting pH was 1.93. The solution remained transparent, and continued to produce suds when shaken. I concluded that the product is not soap.

I then attempted to identify the product using carbon-13 nuclear magnetic resonance spectroscopy (CNMR). This technique allows for the identification of carbon compounds (including oils, soaps, and detergents). It does not detect inorganic compounds such as water, salt, or other minerals.

My initial spectrum had a very weak signal due to a low concentration of carbon compounds. To increase the concentration, it was necessary to remove any excess water. I placed 20.54 g of Ava Dish soap into a 100 mL beaker and placed it into an oven at 140°C for 1.5 hrs. The residue was a white paste weighing 5.54 g. I concluded that the product is approximately 73% water and scent oils.

I extracted the white paste with diethyl ether to separate relatively non-polar compounds like soaps and detergents from ionic compounds like salt and minerals. After filtering the solid from the liquid, the ether was boiled away on a hotplate. This resulted in 2.94 g of a white, gummy, ether-soluble fraction and 0.59 g of an ether-insoluble white powder. A similar result was obtained extracting with hexane.

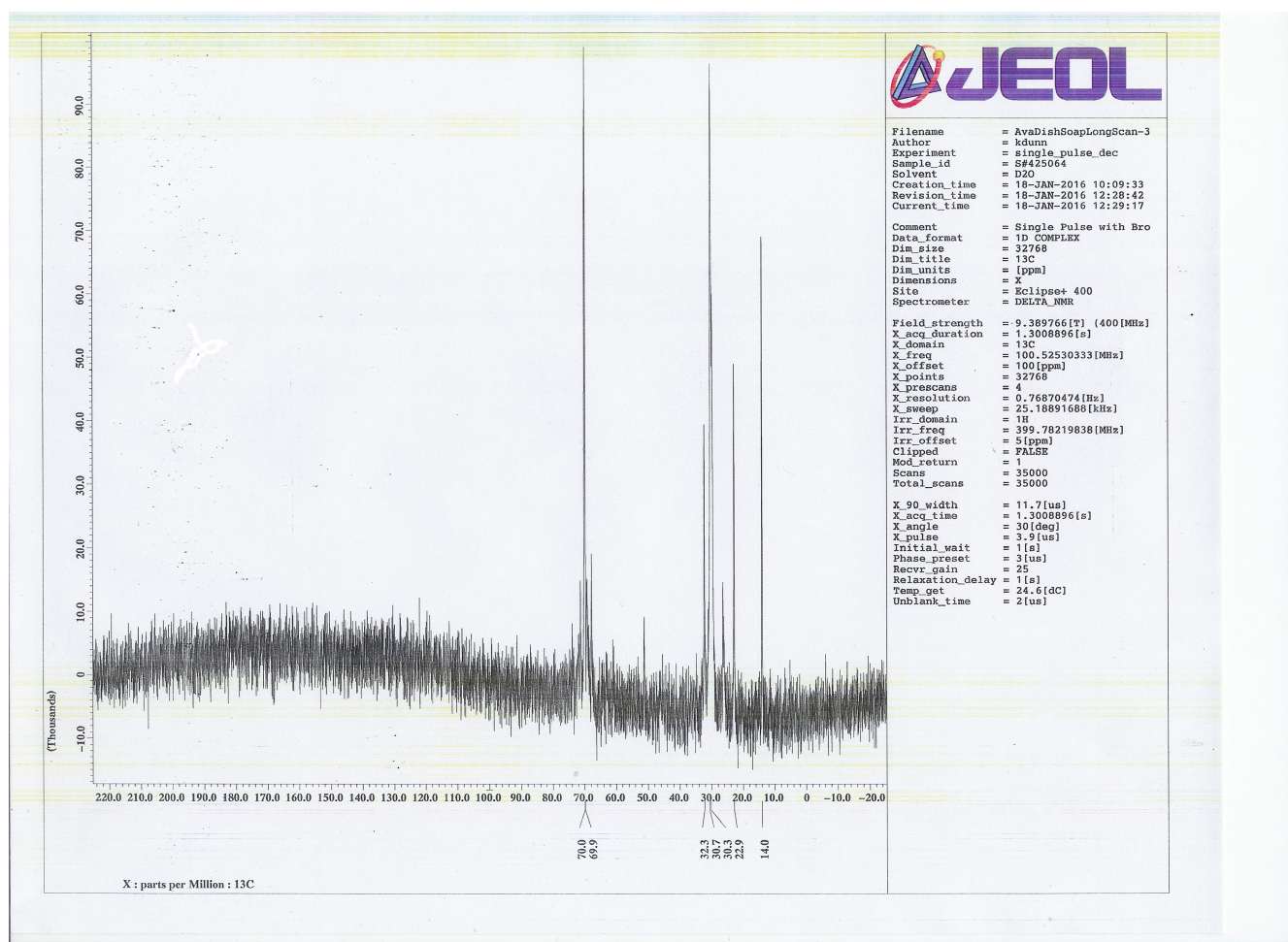
The ether-insoluble fraction was readily soluble in D<sub>2</sub>O. The CNMR spectrum revealed only trace amounts of carbon. I concluded that the white powder is a water-soluble mineral. Sodium or potassium

chloride would be logical possibilities, but I have not tested this powder further.

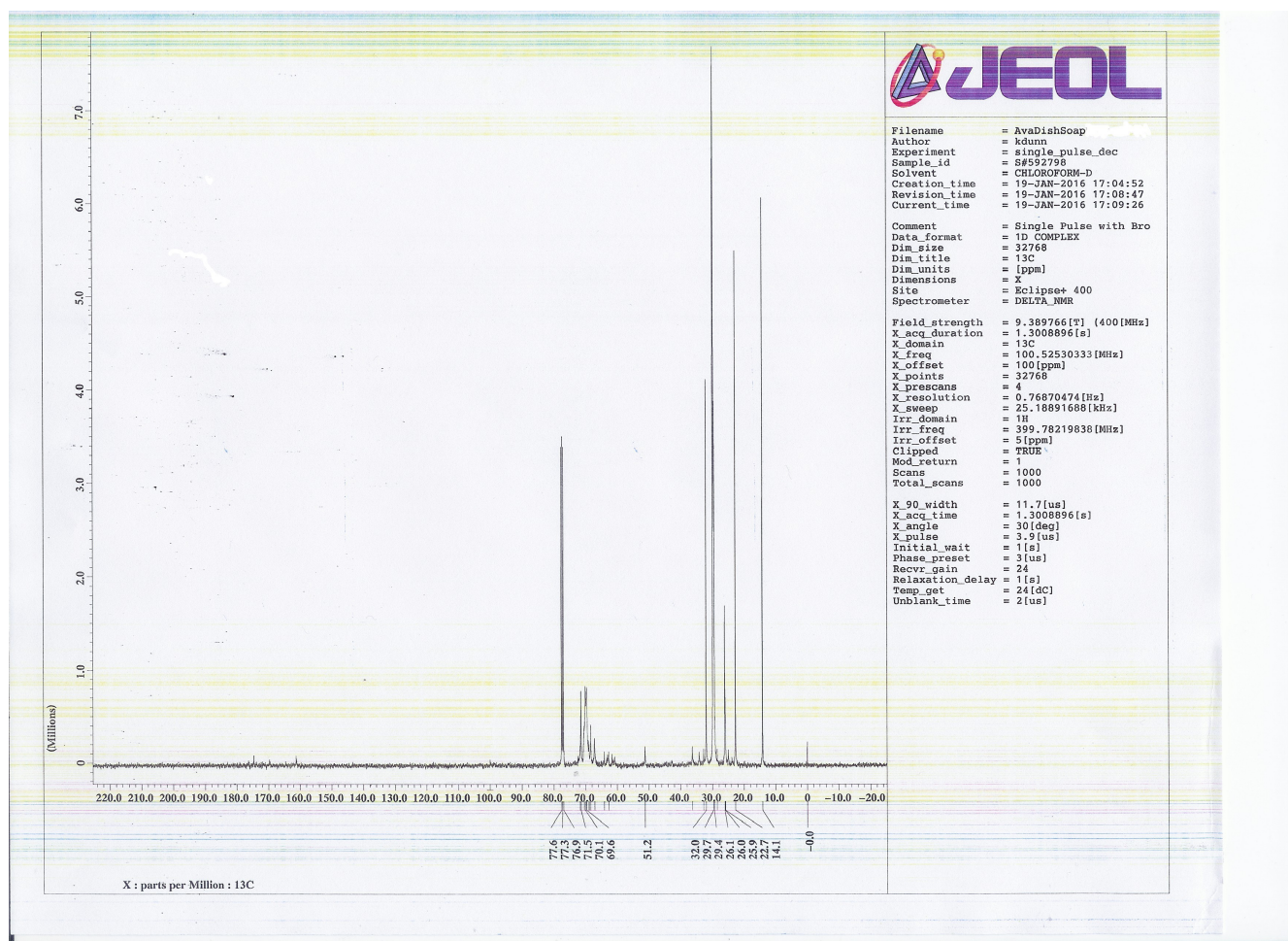
The ether-soluble fraction was dissolved in  $\text{CDCl}_3$ . I compared the CNMR spectrum to those of coconut oil, Dr Bronner's Unscented Baby Soap (a true potassium soap), cocamidopropyl betaine, sodium lauryl sulfate, sodium laureth sulfate, polysorbate 20, cetareth 20, and Bioterge. Of these, only Bioterge is a close match to the ether-soluble fraction of Ava Dish Soap.

I conclude that Ava Dish Soap contains (in order of predominance) water, an anionic surfactant similar to Bioterg (a sodium alkyl sulfonate), a water-soluble mineral such as sodium or potassium chloride, and scent. It does not contain vegetable oil (coconut, palm, or jojoba). It may well be that the anionic surfactant is manufactured from coconut oil, but if that is the case, the ingredients list should specify the surfactant rather than listing raw materials.

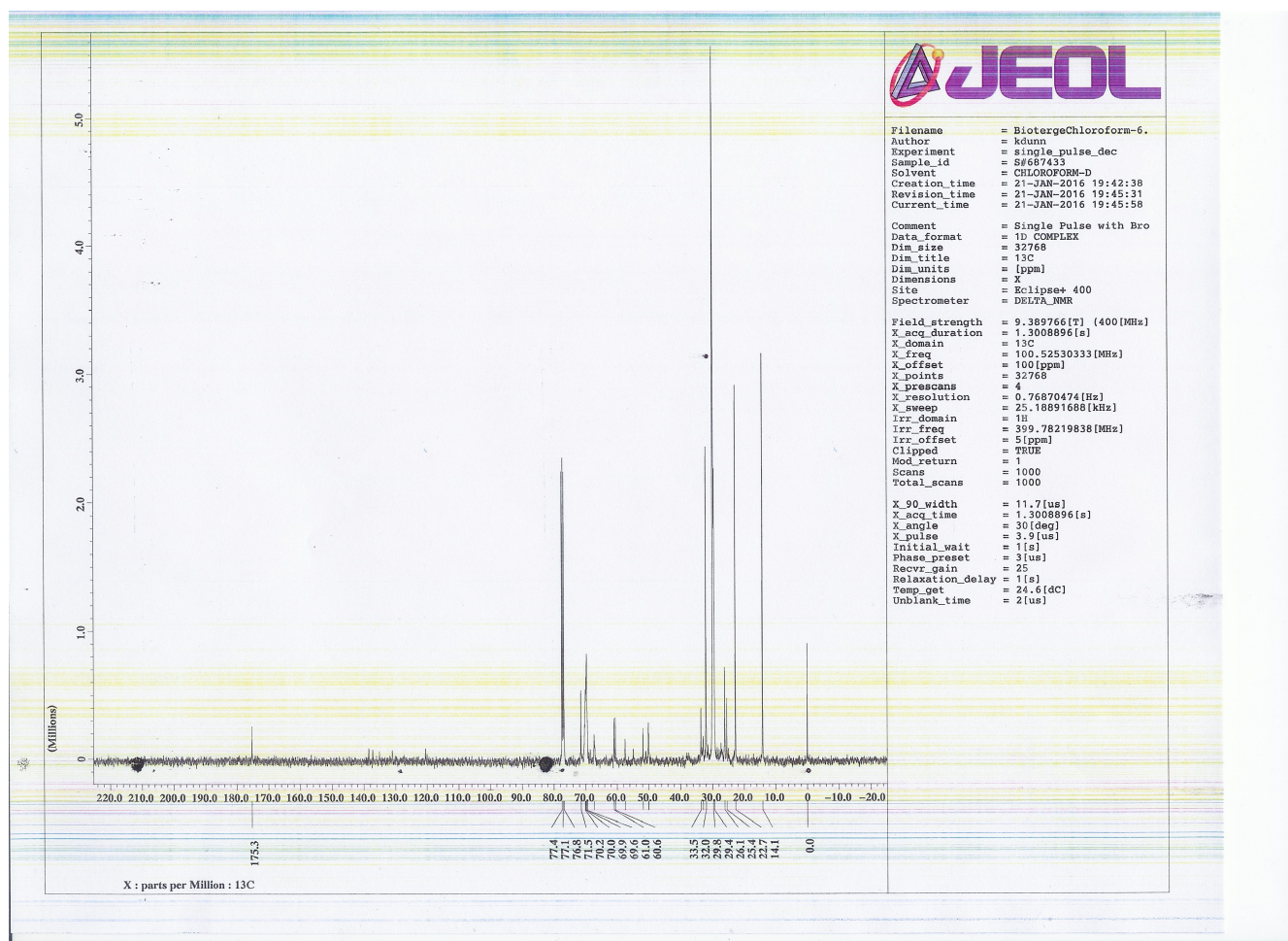
### Detailed Analysis



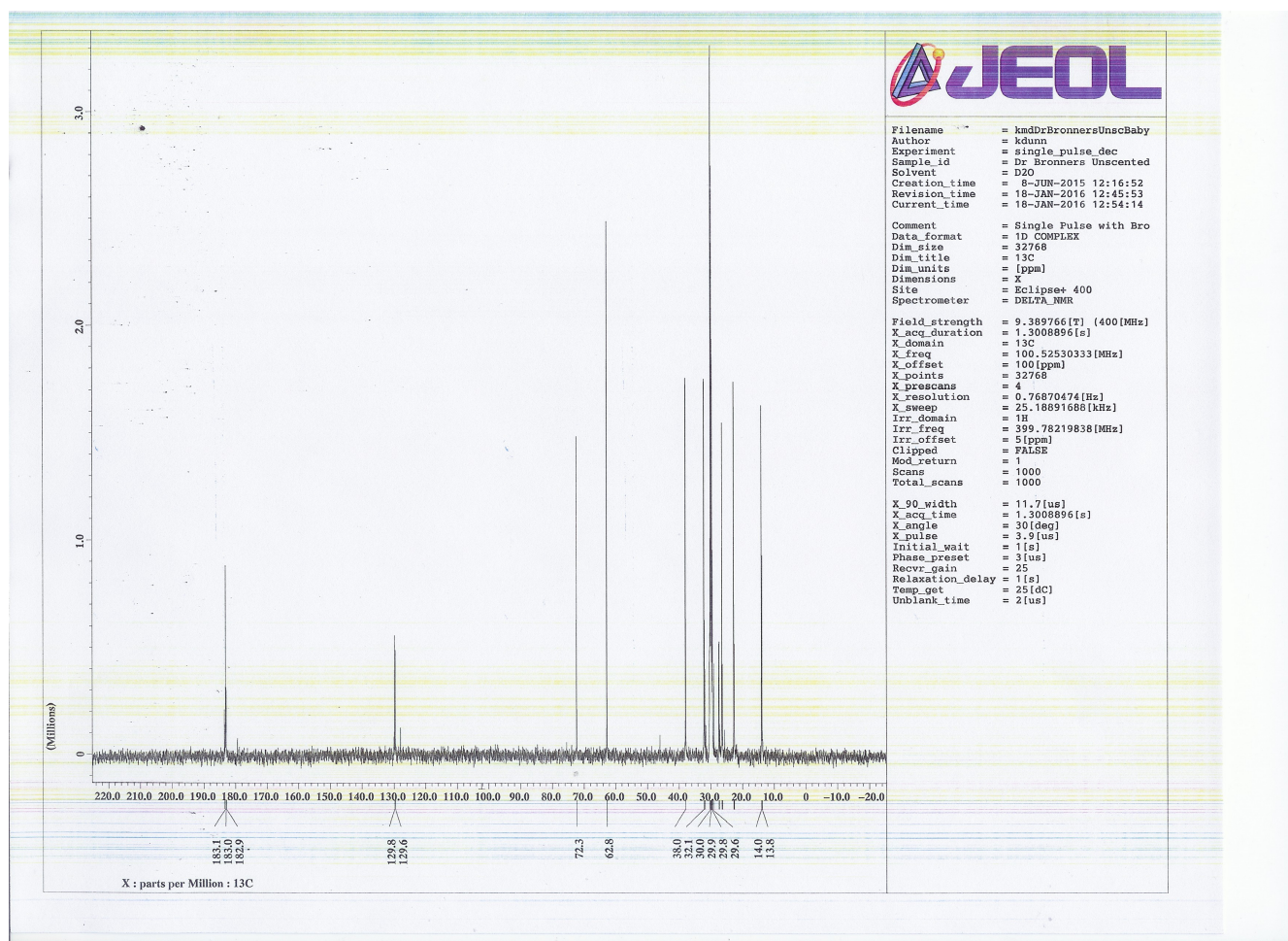
This is the CNMR spectrum for Ava Dish Soap in  $\text{D}_2\text{O}$  (heavy water). The signal strength is poor because of the low concentration of carbon compounds in the product. This does not reflect poorly on the product, since many cleaners contain water as the principle ingredient. Heavy water is commonly used in NMR spectroscopy for water soluble compounds.



This is the CNMR spectrum of Ava Dish Soap concentrated by boiling the water away and extracting into diethyl ether or hexane (this is the hexane extract). The NMR solvent is D-Chloroform. The peaks at 0 ppm and 77 ppm come from the solvent. The remaining peaks are the same as in the previous spectrum, but the signal strength is higher. The peaks from 14 ppm to 40 ppm come from carbon atoms single-bonded to other carbon atoms. The peaks between 50 ppm and 75 ppm come from carbon atoms single-bonded to non-carbon atoms like oxygen, nitrogen, or sulfur. The most prominent peaks are at 14.1, 22.7, 25.9, 26.0, 29.4-29.7, 32.0, 69.6-71.5 ppm.

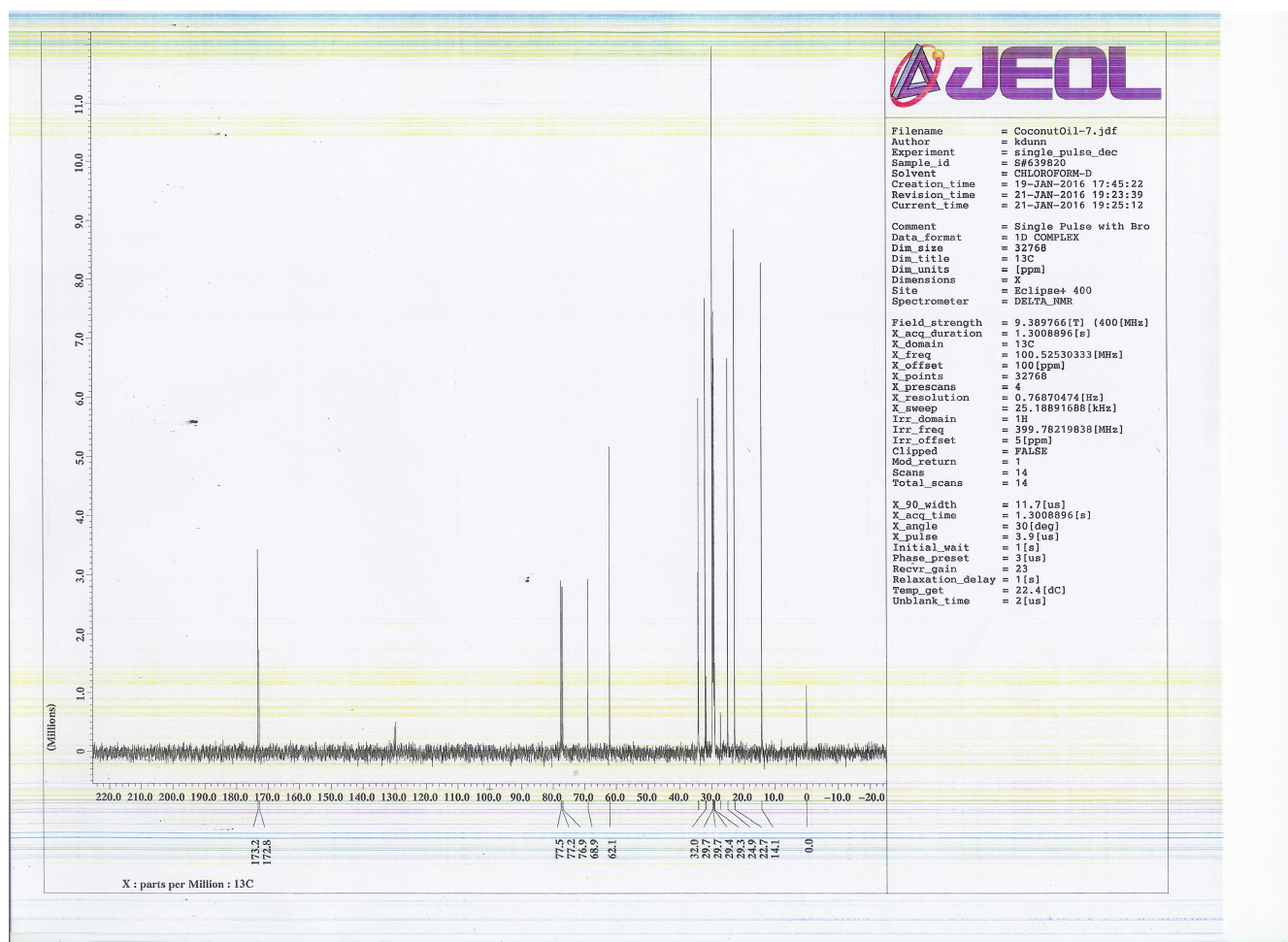


This is the CNMR spectrum for Bioterge detergent, a sodium alkyl sulfonate. The peaks are nearly identical to those of Ava Dish Soap, at 14.1, 22.7, 25.4, 26.1, 29.4-29.8, 32.0, 69.6-71.5 ppm. The peaks near 70 ppm come from carbon singly-bonded to sulfur. The sodium alkyl sulfonates are a whole family of detergents. While Ava Dish Soap and Bioterge may not be identical, they are very close to one another and likely belong to the same class of detergents.



This is the CNMR spectrum for Dr Bronner's Unscented Baby Soap in D<sub>2</sub>O. The peaks between 14 ppm and 40 ppm are similar to those of the previous two compounds because soaps and detergents all have carbons single-bonded to other carbons. The difference is that all soaps contain a carbon double-bonded to oxygen, appearing here at 183 ppm. This peak is absent in both of the Ava Dish Soap samples. I conclude that Ava Dish Soap is not soap.

The peaks at 62.8 ppm and 72.3 ppm are from glycerol, a byproduct when soap is made from vegetable oil. It is removed in some soapmaking processes, but Dr Bonner's leaves it in.



This is the CNMR spectrum of coconut oil. In addition to the peaks from 14 ppm to 40 ppm common to soaps, detergents, and oils, it contains a peak at 172.8 and 173.2 that come from carbon double-bonded to oxygen. The peaks at 62.1 ppm and 68.9 ppm come from carbon single-bonded to oxygen. These four peaks are common to all vegetable oils. If they are present at all in the Ava Dish Soap spectra, they are tiny and obscured by other peaks. I conclude that Ava Dish Soap contains little or no vegetable oil.

### Conclusion

I did not evaluate Ava Dish Soap for cleansing ability, mildness, or other aspects important to consumers. The request made of me was to simply determine whether the ingredients list was accurate. While the product may have been manufactured from vegetable oil, it does not contain vegetable oil. It also does not contain soap. Comparing the spectrum to an admittedly small selection of detergents, the closest match was to a sodium alkyl sulfonate.

Respectfully Submitted  
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 1-22-2016