Georgia Peanut Commission, 2025 Research Report

Utilizing Peanut Oil in Oil-Based Stains and Paints

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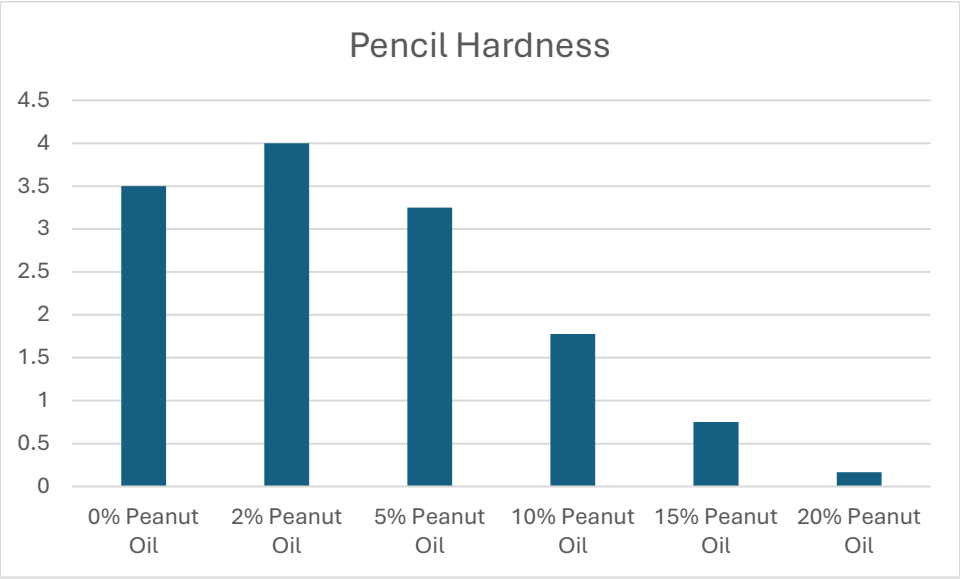
The purpose of this report is to summarize the phase 1 experiments to evaluate the possible use of peanut oil into commercial drying oil products. The first approach was to determine the amount of peanut oil that could be incorporated into a traditional drying oil without compromising durable film formation. Peanut oil was mixed with flax oil (the most commonly used drying oil) in various proportions and formulated with solvent, surface drier and through drier to create a drying oil product suitable for sealing wood surfaces. The mixtures were coated on glass slides and cured to form a solid film through the crosslinking reaction of the unsaturated fatty acids in the oils. These cured films were then tested for pencil hardness using ASTM D3363-22 methodology. It was found that at concentrations up to 5% peanut oil, no significant impact to the film quality was detected. Starting at 10% peanut oil, the hardness dropped significantly, with a precipitous decrease in film integrity at higher concentrations. From these data it is was determined that 5% peanut oil would be suitable for testing on a wood substrate. Pine samples treated with either 100% flax oil or 5% peanut in flax oil exhibited excellent water repellency.



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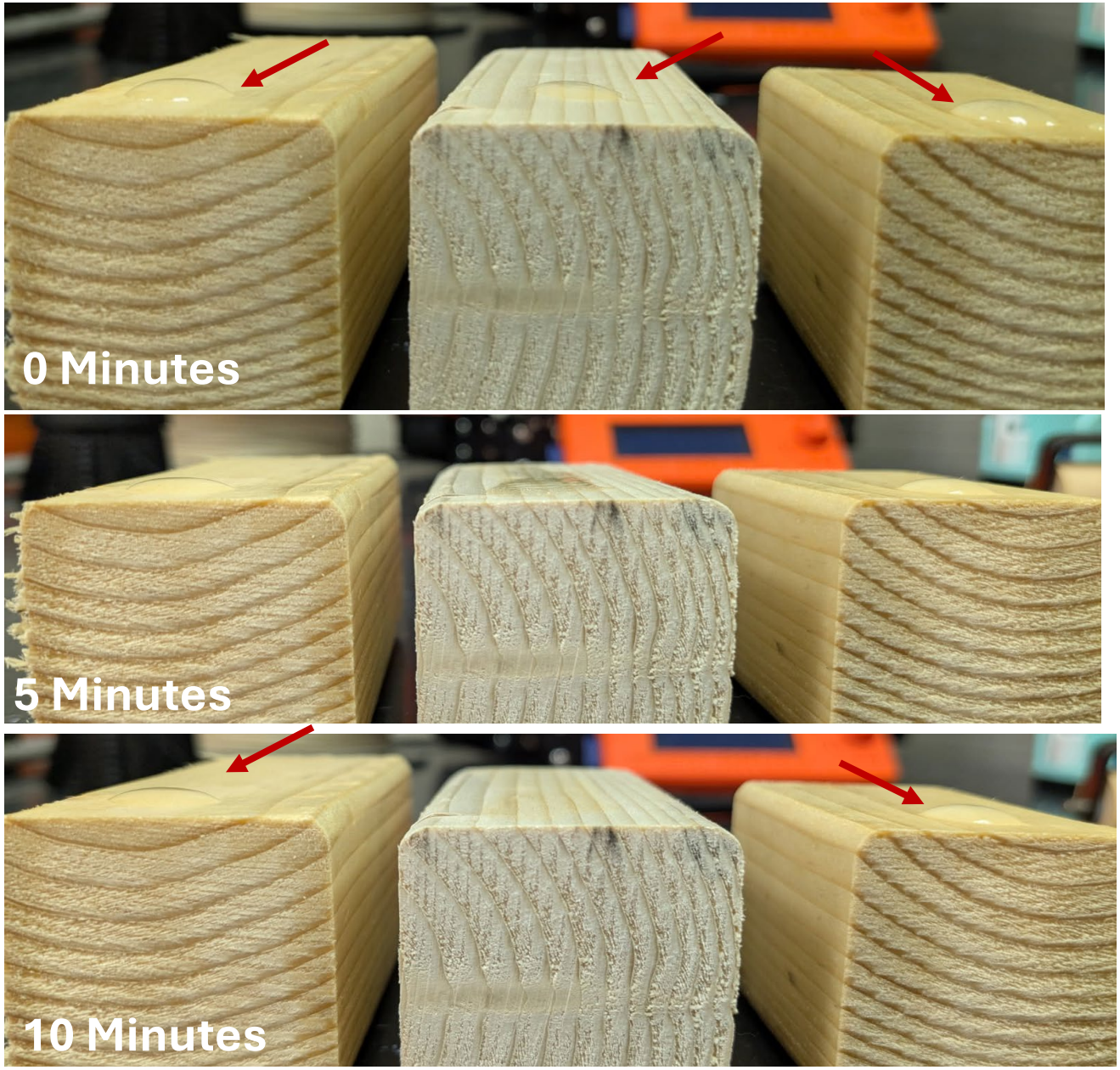

Figure 1: Water repellency (note water beading at red arrows). 100 % Flax (left), 5% peanut (right) and untreated pine (center)

The limitation of utilizing peanut oil in the context of a drying oil is the lack of polyunsaturated fatty acids. These unsaturation points are responsible for forming bonds with neighboring triglycerides, forming a network of cross-linked triglycerides that ultimately form a durable film. Flax oil, the standard example of an ideal drying oil, contains on average 2 of these reactive fatty acids on each triglyceride. This allows each triglyceride to react with 2 other triglycerides, building higher molecular weight and therefore a stronger film. Peanut oil, on the other hand, has roughly half as many of these reactive sites, limiting the degree of polymerization that can occur from oxidation.

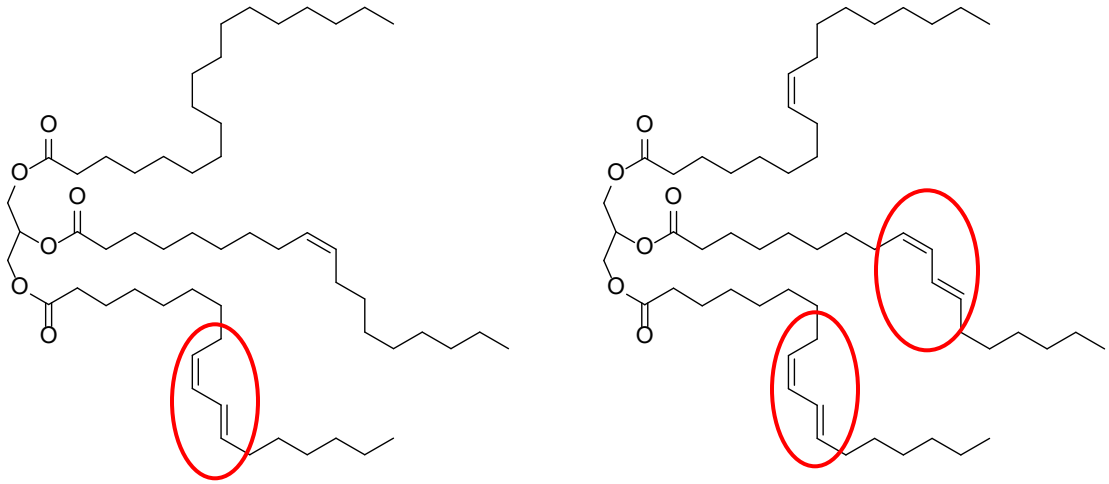

Figure 2:Representative peanut oil triglyceride (left) and flaxseed oil triglyceride (right) with reactive unsaturation points circled

An approach to form durable films without the requirement of high crosslinking density is to chemically convert the peanut oil into a polyester. There are many commercially available paint and stain products that utilize polyesters, including metal and wood paints, deck stains, enamels and urethane paints. They are commercially desired because of their high durability and stability in harsh conditions such as marine environments. For proof-of-concept, the required chemical reaction was conducted with a 50:50 blend of flax oil and peanut oil. The resulting viscous polymer was blended with solvent, pigment, and drying agents to form a titanium-white paint before coating on a wood substrate.

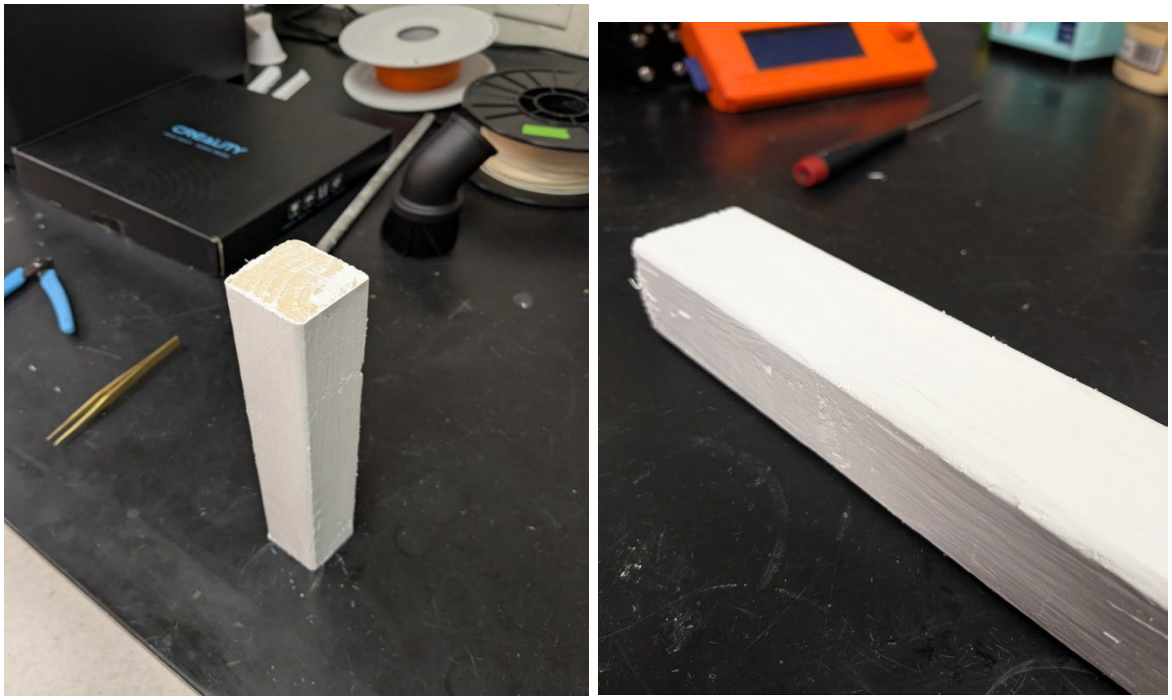

Figure 3: Chemically modified Peanut Oil Containing Paint on Pine Wood

These findings demonstrate that peanut oil is suitable for supplementation into drying oils at a minimum of 5%, with much higher loadings possible in stains and paints with chemical modification. A phase 2 project would focus on maximum loading of chemically modified peanut oil into stains (such as Australian Timber Oil as an industry standard) and paints, as well as the performance of resulting paints on substrates other than wood, such as metal.

Figure 4: Peanut Alkyd Paint on Pine Wood