
RESEARCH ARTICLE

Biocidal Action of Sunflower Oil Based Soaps towards Bread Mould

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ABSTRACT

The antifungal action of soaps prepared from sunflower oil (pure and amended with various organic materials) was examined towards bread mould. The results show that at 2-2.5 % percent concentration, pure (without any amendment) sunflower oil-based soap can completely block the development of mould on bread, just like 70 % ethanol solution. Amendment of the soap with different organic materials like dry shells from *Rapana venosa*, dry maple leaves, dry olive pits, and so on can cause differences in the action of the soap towards mould. The highest effectiveness was observed in the soaps enhanced with *Rapana venosa* dry shells and dry pumpkin seeds.

KEYWORDS

Soap, sunflower oil, bread, mould

ARTICLE DOI: [10.32996/jeas.2022.3.2.4](https://doi.org/10.32996/jeas.2022.3.2.4)

1. Introduction

The mould on bread is due mainly to the fungal infestation of species like *Penicillium sp.*, *Aspergillus sp.*, and *Fusarium sp.* The mould can cause, on the one hand, a lot of losses in bread which is one of the staple human foods, and on the other – the fungal species can produce a lot of mycotoxins which can cause public health problems (Legan, 1993; Gerez et al., 2009). The fact that bread is very susceptible to mould can be used for rapid evaluation of the possible biocidal action of different substances and mixtures. The soap is the oldest known antimicrobial and biocidal product in human history and played an important role in many world civilizations. Soaps have been used for thousands of years as part of religious ceremonies and daily life and are important for healthcare professionals in preventing the spread of disease (Gibbs, 1939; Kirsner & Froelich, 1998). In recent years the soaps have gained increasing popularity as pesticides, too, especially those derivatives from plant oils such as sunflower, olive, rapeseed, and other oils. The soaps can be very effective against many soft body insects like aphids and caterpillars, but also there are plant protection products based on soaps that are registered against plant pathogenic fungi and even – against weeds (Weinzierl, 2000). The soaps have zero risk resistance risk, very low or zero toxicity towards humans and the environment, are fully water-soluble, and are easy to prepare and spray. They are actually surfactants which mean that there is no need for additional synthetical surfactants addition in the pesticide solutions. Cheap and easy for production (Abbasi et al., 1984; Puritch, 1981; Borden & Dale, 2019). The soaps can also be combined with other synthetically or biologically pesticides to increase their effectiveness (Kaya et al., 1995; Fournier & Brodeur, 2000; Oparaeke et al., 2006). However, in most cases, the soaps have weaker pesticide activity in comparison with the other synthetically pesticides, plus the increased risk of phytotoxicity due to their application. Such problems invoke the need for the development and testing of new soaps as future plant protection products, especially against phytopathogens. Of course, such kind of evaluation can also be used for other possible pesticide substances both of natural and synthetically origin (Félix et al., 2017; Akuaden et al., 2019; Hasna et al., 2015).

This paper is presented a rapid and cheap *in vitro* method for evaluation of the antifungal biocidal effect of sunflower oil based soap alone and enhanced with biologically active substances from different natural materials with bread.

2. Methodology

Sunflower oil based soaps were prepared by cold method - 50 ml of sunflower oil was mixed with 40 ml 90 % (m/v) KOH water solution. Due to the interaction of oil and water solution of potassium hydroxide, the soap was formed immediately. The soap was used as an extraction agent for making biocide extracts from various materials such as; fruit pits, snail shells, and plant leaves. The soap is diluted with distilled water up to 5 % (m/v) concentration – this is the highest possible concentration at which, given soap is in liquid, spray able form. In the higher concentration, the prepared soap became like jelly. After that, the soaps were mixed with the given organic materials for a 1-month maceration process. After this period, the extracts were filtered.

The pieces of bread (6 grams) were soaked in the tested soap solutions and placed in 5 layers of filter paper in the plastic cups (500 ml volume) covered with plastic folio. The cups were incubated at 22°C for two weeks. After that, the percent of mould infection on bread was examined and accounted for. As a comparative variant, 70 % (v/v) ethanol water solution was used.

3. Results and Discussion

Figure 1 below is presented the anti mould effect of sunflower oil based soap. The initial tested concentration was 5 %. The soap was diluted additionally with distilled water to establish the minimal inhibitory concentration toward bread mould.

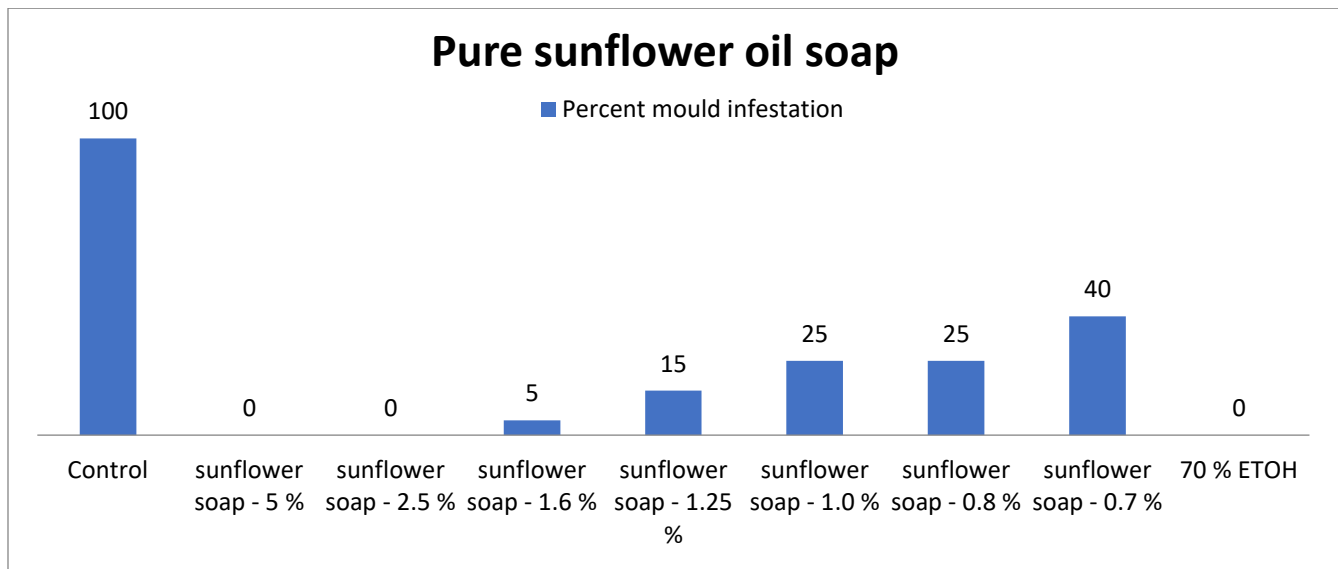


Figure 1. Effectiveness of the pure sunflower soap toward bread mold

From the received results, it is clear that up to 2-2.5 % percent concentration, pure (without any amendment) sunflower oil based soap can completely block the development of mould on bread, just like 70 % ethanol solution.

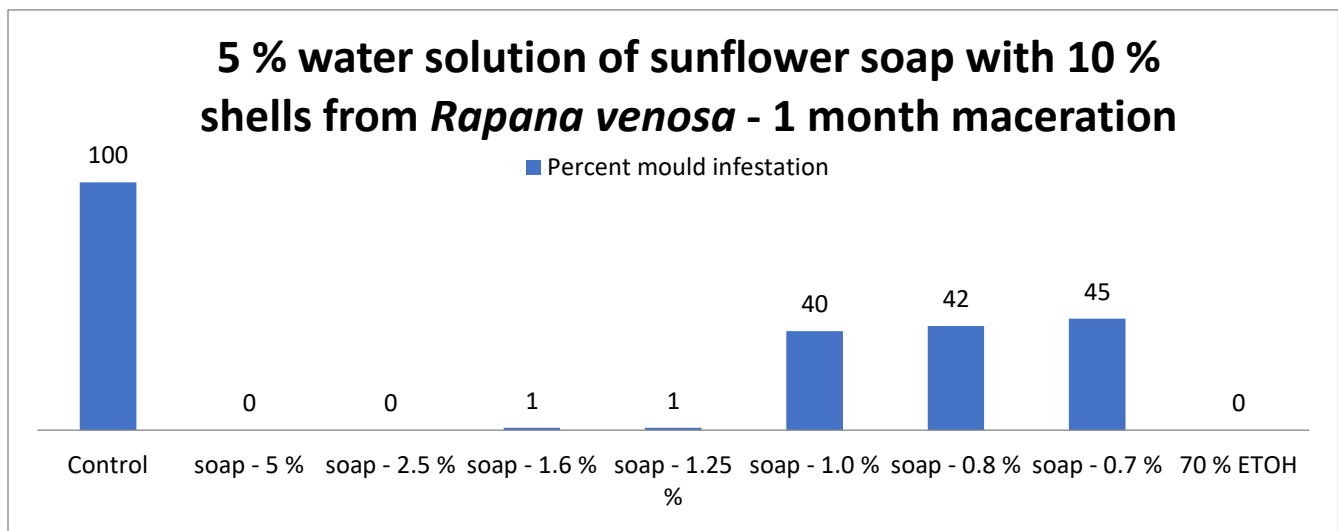


Figure 2. Effectiveness of the sunflower soap amended with *Rapana venosa* shells towards bread mold

The results in the figure above show the difference between "pure" soap and soap enhanced with dry shells from *Rapana venosa* – double less concentration is achieved block of bread mould

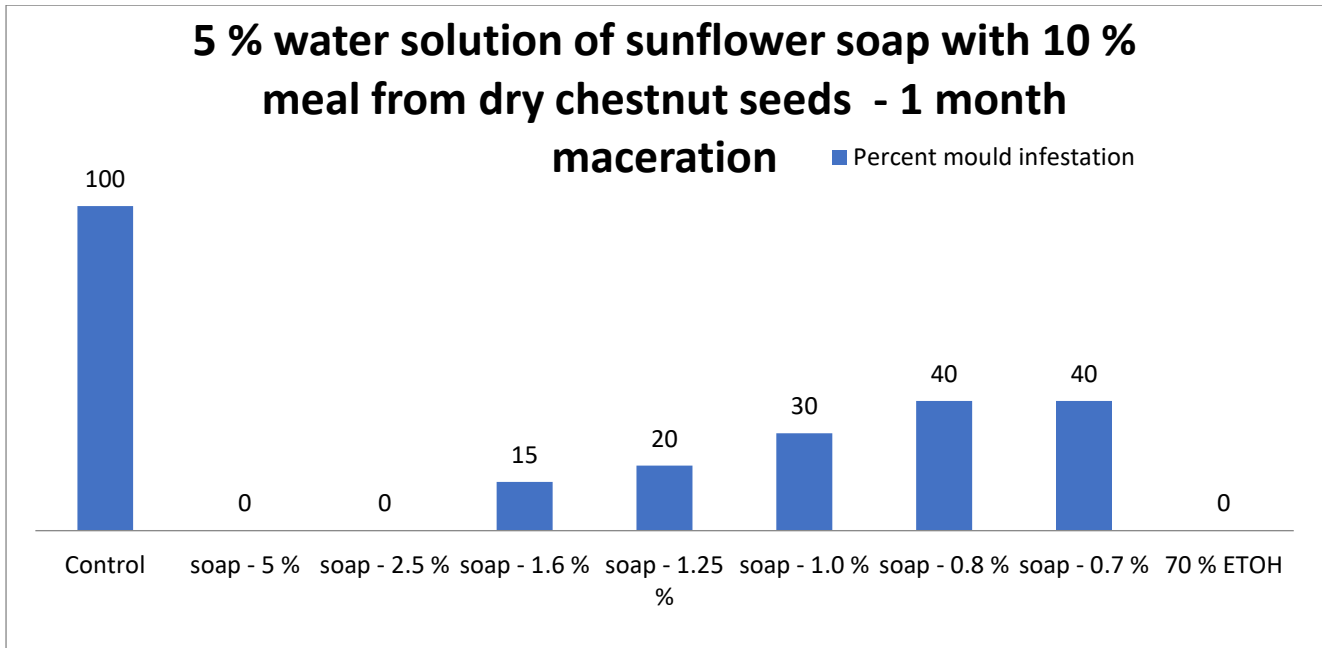


Figure 3. Effectiveness of the sunflower soap amended with a meal from chestnut seeds towards bread mold

The figure above shows that soap addition of meal from dry chestnut seeds actually decreases its effectiveness slightly towards bread mould.

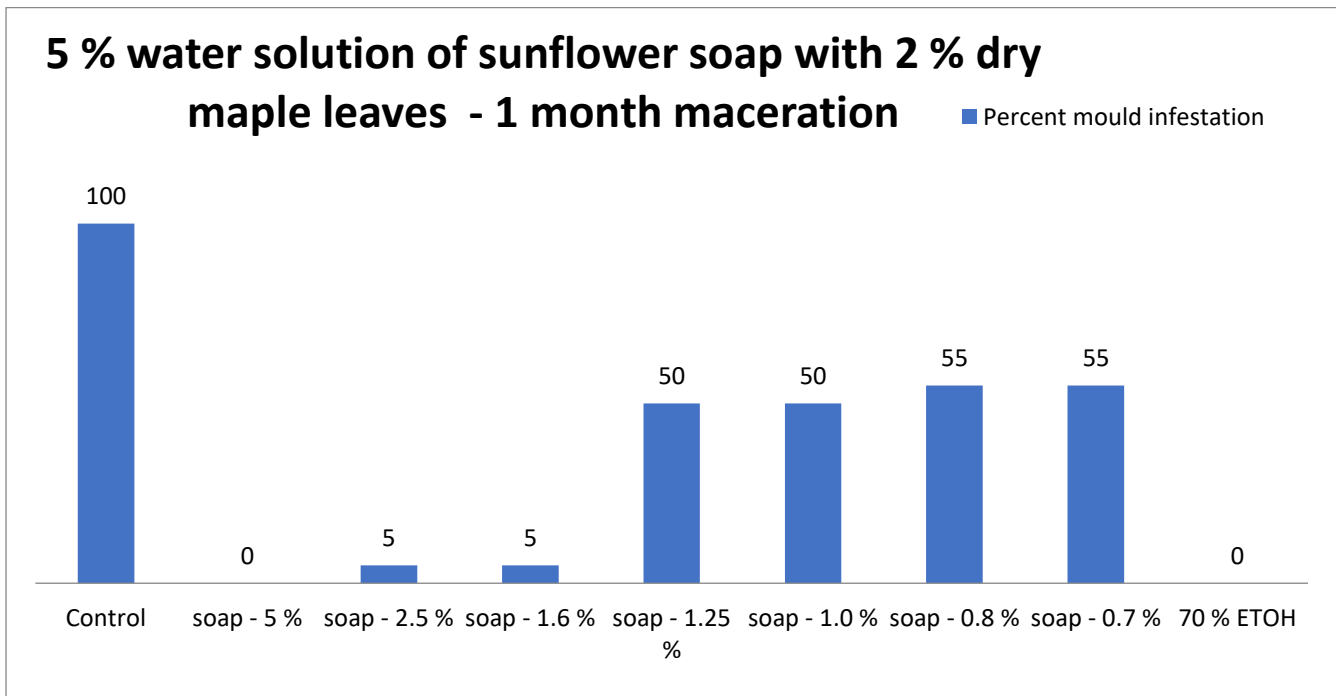


Figure 4. Effectiveness of the sunflower soap amended with dry maple leaves towards bread mold

The amendment with dry maple leaves extract decreases even more effectiveness – Figure 4

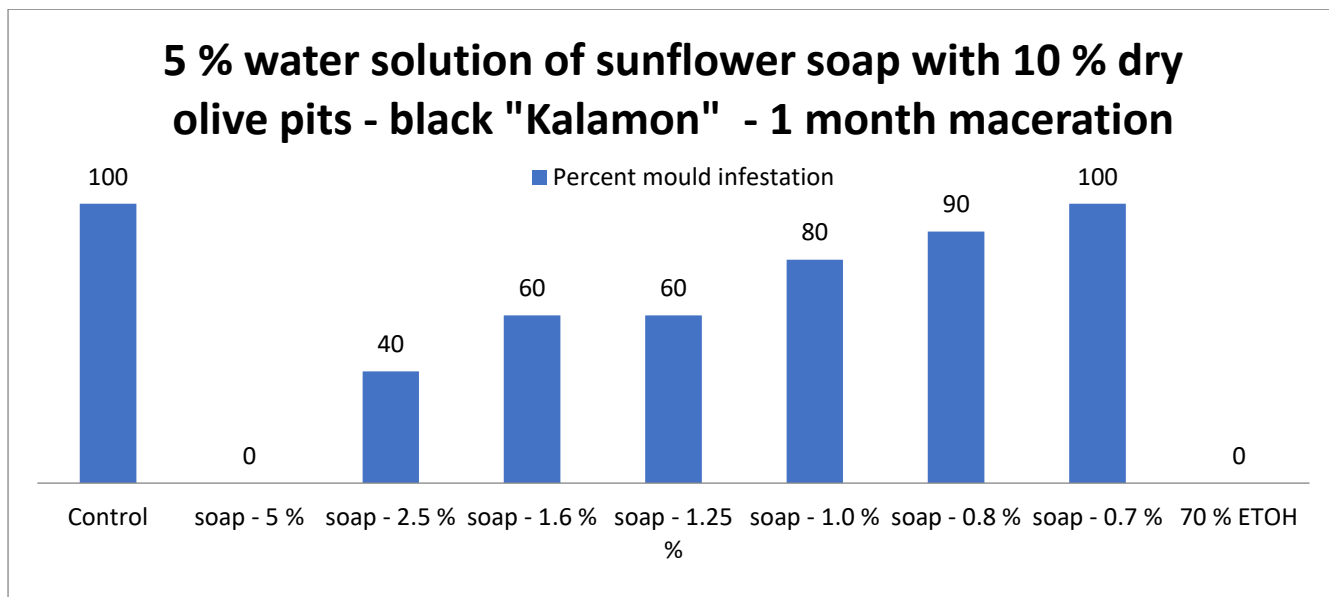


Figure 5. Effectiveness of the sunflower soap amended with dry olive pits "Kalamon" towards bread mold

Using dry pits from black table olives "Kalamon" cause, soap to have full effectiveness towards mould on bread only at 5 % (m/v) concentration.

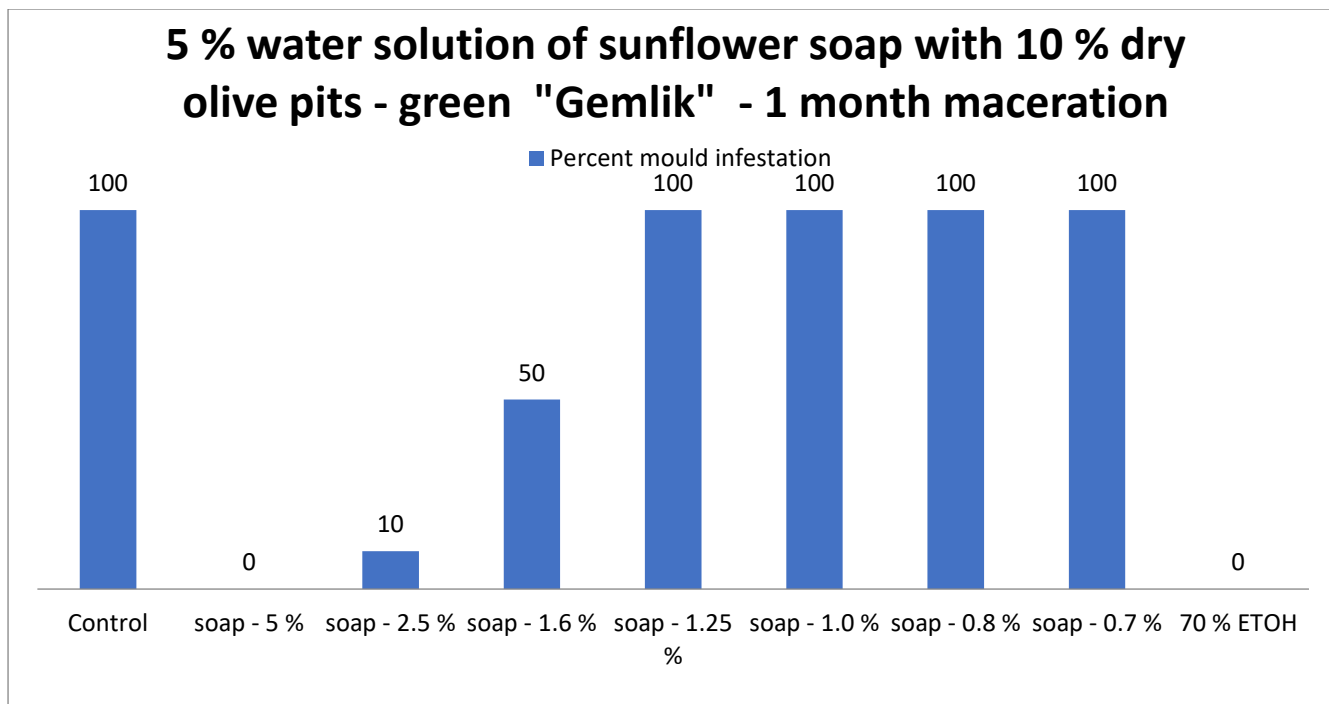


Figure 6. Effectiveness of the sunflower soap amended with dry olive pits "Gemlik" towards bread mold

From the figure above, however, it is shown that different varieties of olive pits can affect the effectiveness also – with using pits from green olives "Gemlik", the mould infestation on bread at 2.5 % concentration is 10 %, or with 75 % less in comparison with the black olives pits "Kalamon."

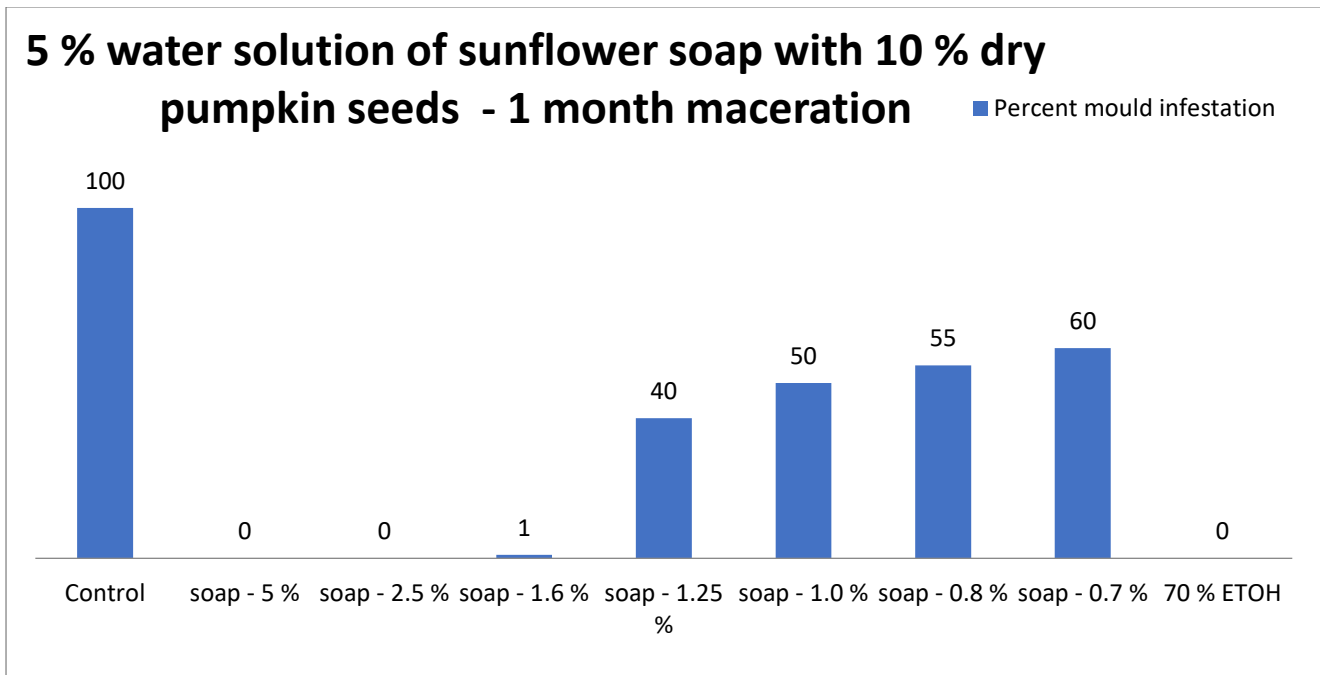


Figure 7. Effectiveness of the sunflower soap amended with dry pumpkin seeds towards bread mold

Surprisingly, amendment of soap with extracts from dry pumpkin seeds increases effectiveness towards mould. In 1.6 % concentration, the percent mould infestation was only 1 %, in comparison – 5 % with "pure" soap.

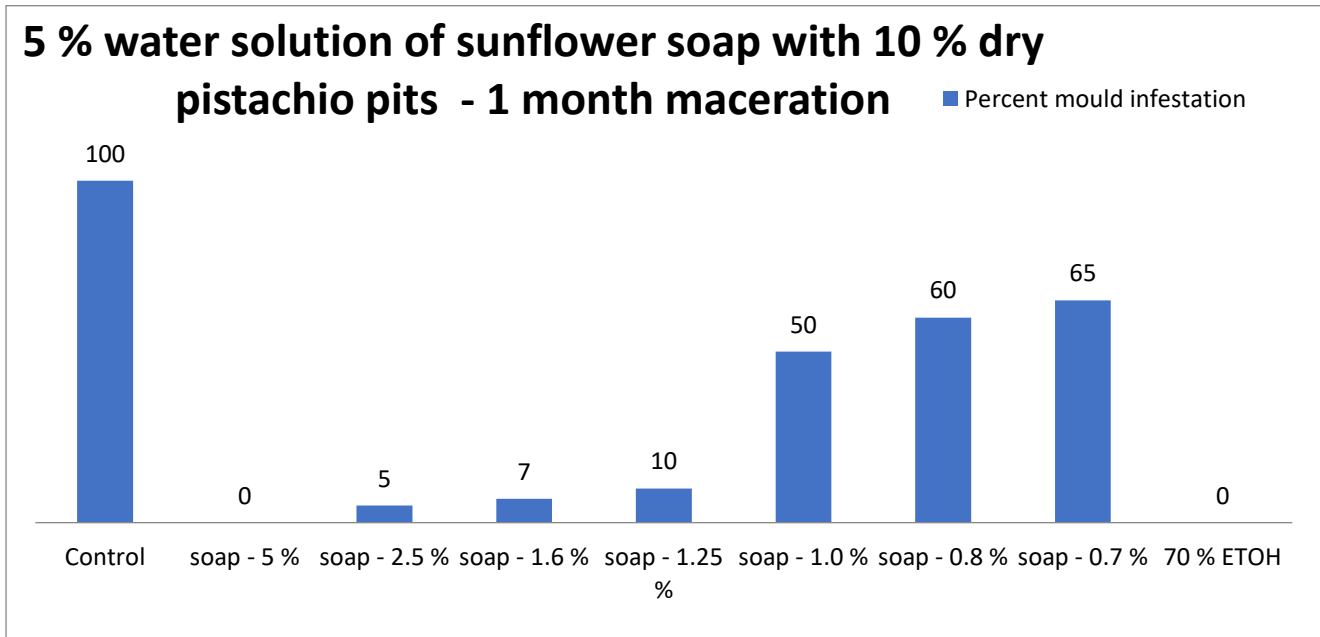


Figure 8. Effectiveness of the sunflower soap amended with dry pistachio pits towards bread mold

However, dry pistachio pits also decrease the effectiveness of the soap, similar to dry maple leaves.

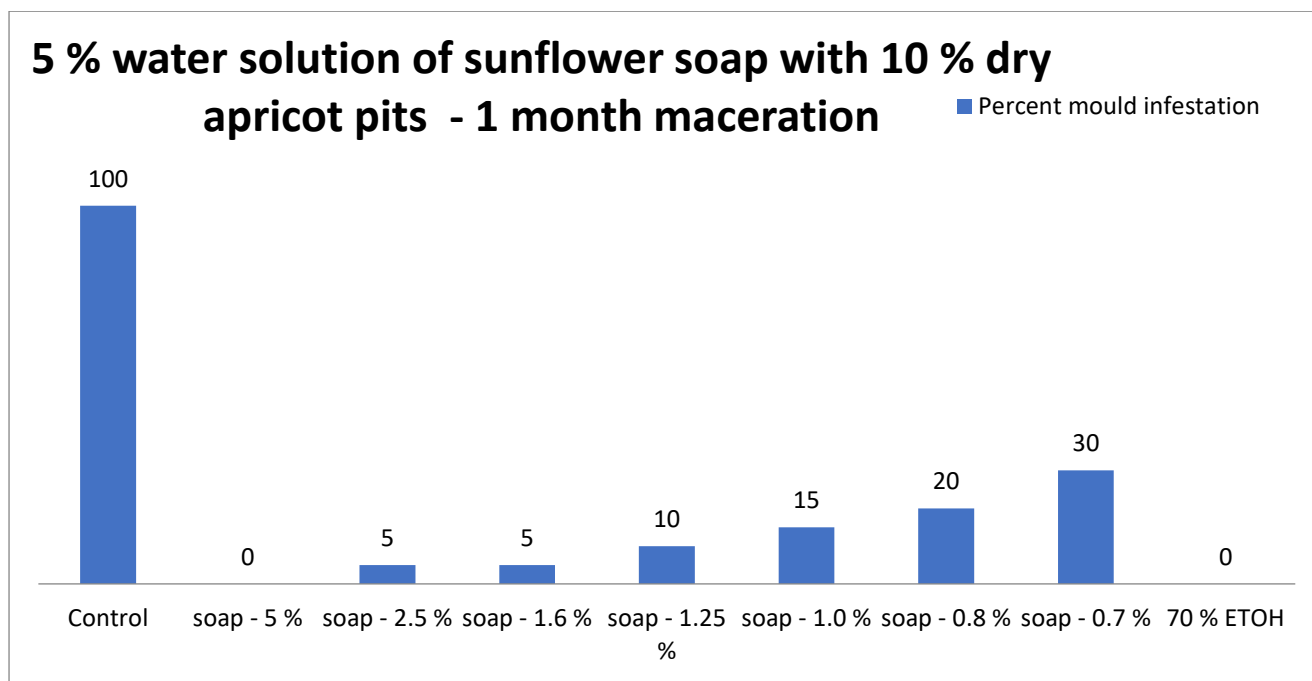


Figure 9. Effectiveness of the sunflower soap amended with dry apricot pits towards bread mold

The soap amended with dry apricot pit extracts also has similar effectiveness as pistachio pits.

4. Conclusions

The results from conducted present study show that sunflower oil based soap prepared by the method described in the section "Methodology" can achieve in all tests full effectiveness towards mould on bread at 5 % concentration. Using the soap at this concentration as an extraction agent with different organic materials (wastes) from plant or animal origin by the method of maceration and respectively enhancing the soap by this way can change the effectiveness towards mould. The highest effectiveness was observed in the soaps enhanced with *Rapana venosa* dry shells and dry pumpkin seeds.

Funding: This research received no external funding

Conflicts of Interest: The author declares no conflict of interest.

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