CASNR Honors and Creative Achievements project

Mushroom Drying and the Benefit to Industry

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Abstract

Extending the shelf life of mushrooms is important to mushroom producers and consumers. Currently mushrooms, regardless of the species, can only be stored for a few weeks before they diminish greatly in quality. Finding a method to achieve an extended shelf life would benefit both the food industry and consumers.

Drying mushrooms is one method that would extend the shelf life of mushrooms. Dried mushrooms can be used in many different types of products. Furthermore, elevated temperatures during drying enhance enzymatic reaction that can result in improved flavor of dehydrated mushrooms.

Over 80% of total production of Agaricus mushrooms, including white and brown strains - Crimini and Portabello - are sold on the fresh market as whole or sliced mushrooms. Currently, the pieces of sliced mushrooms that are smaller in size or have irregular shape are considered to be waste and have to be disposed of. The sliced products are still of good quality and could be used in a process such as drying. This would provide mushroom growers with a way to profit from the product that they currently have to dispose of. Dried mushrooms could be used by consumers and by industry in applications such as pizzas, soups and sauces. Consumer benefits include the fact that they can purchase mushrooms to use in products that do not need fresh mushrooms and be able to store the mushrooms for a longer period of time. Producers would reduce expenses required to dispose of organic waste and would gain additional profit from value-added products.

Introduction

Drying mushrooms can have benefits to both consumers and mushroom producers. Consumers would benefit by having mushroom products that could be stored for a longer amount of time making it a more convenient ingredient to be used in recipes. The mushroom producers would benefit by having a means to reduce the amount of waste from the slicing process.

Drying is a relatively simple process that has been used for many years as a means to preserve the shelf life of products. Though there are other methods that can be used such as freeze-drying, the low cost of drying highly outweighs the slightly higher quality that is achieved by freeze-drying, which takes several days to complete and is very costly.

Methods

The drying process for this research consisted of using small food dehydrators with adjustable temperature settings (Nutri-Flow, Frorest Gravel, OR). Mushroom samples were collected on site in a local mushroom production facility (Monterey Mushrooms, Inc., Loudon, TN) and processed in the Food Science and Technology Department. Mushrooms were dried in two different dehydrators both of the model listed above. From previous experiments it was determined that a dehydrator temperature of about 60^{o}C preserved flavor, aroma, and color the most adequately. The quality was evaluated by determining dry weight and water activity (Aqualab 3TE, Pullman, Washington).

The mushroom samples were collected from the local mushroom production facilities cutting operation. They consisted of sliced whole white mushrooms that had been pre-washed in the plant before slicing. Enough samples were collected so that a single tray could be filled with mushrooms for drying. The dehydrators were turned on and allowed to warm to the desired temperature before the mushrooms were placed in the dehydrator. While the dehydrators were warming the collected mushrooms were placed on the drying trays. While placing the mushrooms on the trays, any mushrooms that look damaged were removed. This allowed the identification of drying changes to be more apparent. The trays were then weighed and placed in their individual dehydrators.

The mushrooms were dried at 60^{o}C for 5 ½ hours. A sample from each dryer was removed every 30 minutes for the entire time period. The samples were tested for water activity and also examined for their percent moisture. The water activity was measured using the Aqualab machine listed above. The percent moisture was measured by weighing the mushroom samples then placing them in a drying oven (Napco E series, Winchester, Virginia) and reweighing the samples after they have completely dried. This process took about 2 hours for the first few samples but time was reduced as the dehydrators removed more of the water. The drying oven was placed at 90^{o}C.

Results and Discussion

The results of the data showed that drying mushrooms could be an efficient way to reduce the amount of waste that is incurred by the process of slicing mushrooms. The color of the mushroom did darken due to the drying process. Even though they were a darker color, they are still good quality products that can be used in several products like in soups or for pizza toppings. The drying of mushrooms can help reduce the large amount of waste that is incurred during the slicing process and allow mushroom producers to make money from the waste from the slicing process.

The results also showed that as water activity is reduced the percentage of moisture in the product was too. There was a relationship between both water activity and percentage moisture to the amount of time spent in the dehydrator. As the amount of time in the dehydrator was increased the water activity and the percentage moisture decreased.

Upon reviewing a graphical representation of the data it was found that for the first few samples removed from the dehydrator varied in both percentage moisture and water activity. This is most likely due to differences in moisture in the first 90 min after which the dehydrators showed more even drying patterns.

Since there has been very little research done on the drying of mushrooms the water sorption isotherm was compared to examples for other products. Upon this comparison it was shown that drying of mushrooms shows a desorption curve due to starting with a high percentage moisture and going to a lower percentage moisture.

Figure 1. Water sorption isotherm for the drying of mushrooms.

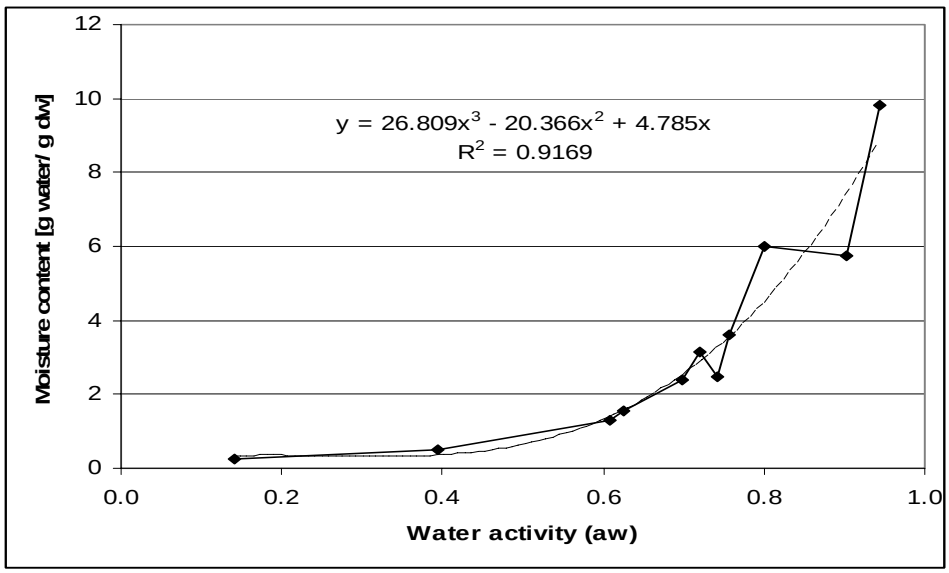


Figure 2. Water activity and percentage moisture over time for the drying of mushrooms.

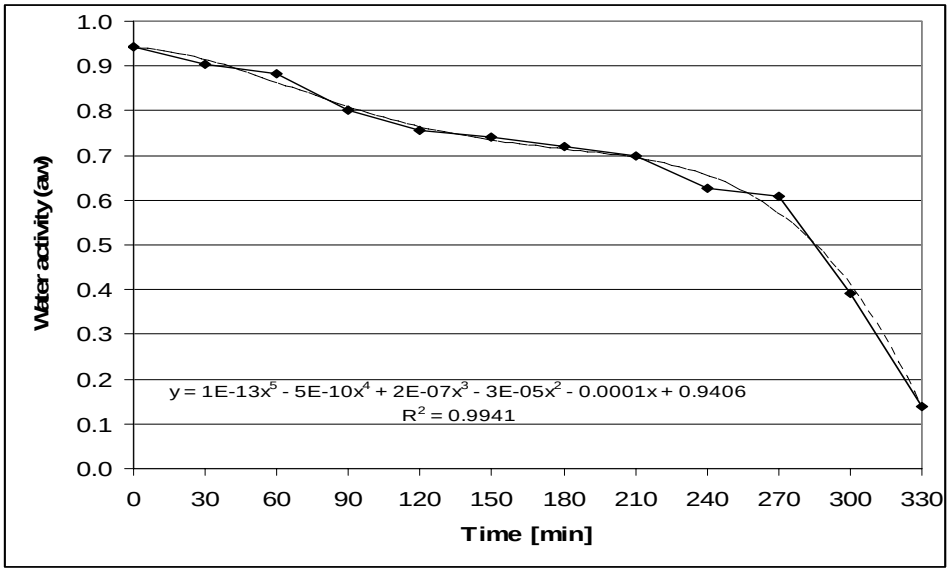
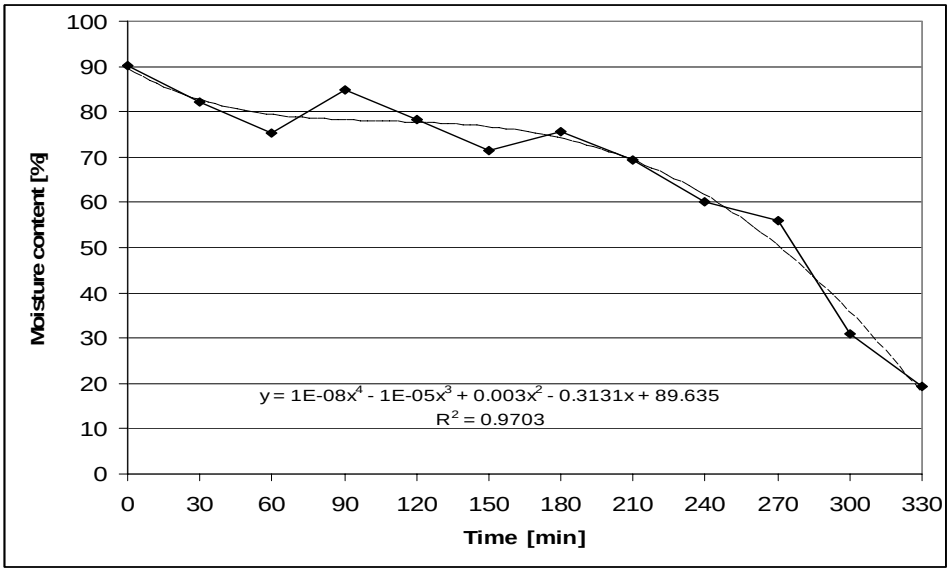


Figure 3. Reduction of moisture content during drying of mushrooms.



Conclusion

The drying of mushrooms is a great way for mushroom producers to make use of the waste products that are incurred during the slicing operation. This will allow them to produce a value-added product from the product that is currently being disposed of. Though the price of dried mushrooms are lower than fresh, the benefits of drying can reduce the overall cost that the mushroom growers experience due to the waste disposal.

For extended research in this area it would be recommended to use a dehydrator that would dry the product more evenly. The other possibility would be to experiment with different drying temperatures. A higher initial drying temperature may dry the products in a more uniform fashion, however, the temperature would have to be reduced to keep the mushrooms from over- drying too rapidly and causing the color to become unacceptable very quickly.

References

Christen G Smith JS. 2000. Food Chemistry: Principles and Applications. West Sacramento, CA: STS.