

Faster and more effective analysis of antioxidant compounds in tomatoes using microwaves

What is this research about?

Phenolic compounds are a group of naturally occurring chemicals commonly found in fruits, vegetables, and grains. In recent years, scientists have begun investigating whether eating phenolics may have health benefits for humans. Phenolic compounds are known to act as antioxidants in the body, preventing damage to human cells by neutralizing harmful molecules called free radicals. The stress on the body associated with these free radicals has been linked to aging and several chronic diseases such as cancer and coronary heart disease. The tomato, which is one of the most widely eaten fresh and processed vegetables in the world, contains antioxidants including phenolics, carotenoids, and vitamins C and E. To figure out which phenolics are found in tomatoes, and at what levels, scientists need to find ways to extract or isolate these compounds. Once extracted, the phenolics can then be identified and measured. The usual solvent extraction method is time consuming. A promising and much faster method is Microwave-assisted extraction (MAE), which separates out the phenolics by heating a mixture of pureed tomato and ethanol.

What did the researchers do?

The phenolics in tomato samples from twenty different varieties were extracted using either the conventional solvent extraction method or the microwave-assisted extraction (MAE) method. Each sample was then chemically analyzed in order to identify and measure the concentration of the phenolic compounds present. Next, the antioxidant activity of each sample was assessed using two different tests, FRAP (ferric reducing antioxidant power) and ORAC (oxygen radical absorption capacity). The researchers also looked at which microwave temperatures, ethanol concentrations, and extraction times were optimal for MAE.

What you need to know:

Microwave-assisted extraction was found to be a more effective and less time consuming technique for measuring the amounts of phenolics in tomatoes. Although not as accurate as more sophisticated chemical analyses, the FRAP test for antioxidant activity was a good measure of total phenolic content.

What did the researchers find?

The tomato varieties differed from one another in terms of total phenolic content (TPC) and total phenolic profiles (TPI), as well as in the antioxidant activity. The FRAP measure of antioxidant activity was found to be tightly linked to the values of TPC and TPI, but there was no clear relationship between the ORAC measure of antioxidant activity and TPC/TPI. The MAE method produced extracts with higher antioxidant activity and total phenolic content compared to the solvent extraction method. The best extraction conditions for the FRAP test were a temperature of 96.5 degrees Celsius, an ethanol concentration of 66.2%, and an extraction time of 2.06 minutes. For the ORAC test the ideal conditions were 96.5 degrees Celsius, 61.1% ethanol, and 1.66 minutes, respectively.

How can you use this research?

Tomato breeders and processors can use this research to more accurately and more rapidly measure the levels of phenolics in their tomato varieties and tomato-based products.

Plant scientists can further this research by investigating whether the microwave-assisted extraction method would be helpful for analyzing phenolics in other crop plants, as well as the optimal MAE conditions for these plants.

About the University of Guelph researcher:

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