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A collaboration between C&EN and
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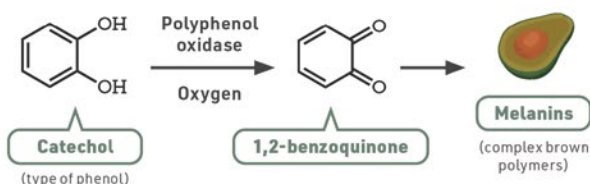
Kitchen chemistry hacks explained



Cooking is chemistry, so it should come as no surprise that chemical knowledge can help in the kitchen. Here are four practical tips and the science behind them.

Slow fruit browning

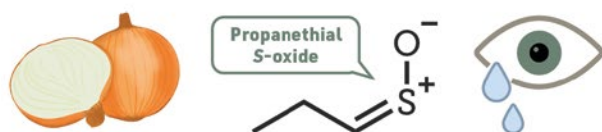
Fruits such as apples and avocados contain phenols. Exposure to oxygen converts phenols to quinones. Cut fruit cells release the enzyme polyphenol oxidase, which speeds up this process. Quinones polymerize into brown polymers called melanins.



Adding acids, such as lemon or lime juice, inhibits the activity of polyphenol oxidase, slowing browning. You can also block oxygen by wrapping the fruit in cling film or submerging it in water.

Chop onions more comfortably

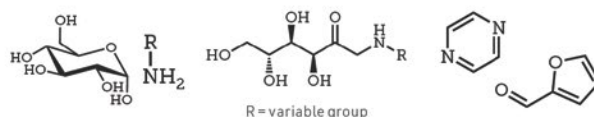
When you cut onions, they release alliinase enzymes, which break down amino acid sulfoxides. This breakdown yields 1-propenesulfenic acid, which the lachrymatory-factor synthase enzyme in the onion transforms into propanethial S-oxide. This is the compound that stings your eyes.



Using a sharp knife damages onion cells less, reducing the eye-watering reactions. If you chill your onions before chopping, the rate of the reaction is reduced, as is the volatility of propanethial S-oxide.

Brown onions more quickly

Onions brown because of the Maillard reaction, which happens when amino acids and sugars are heated and react together. This reaction occurs in three stages.



Sugars and amino groups react

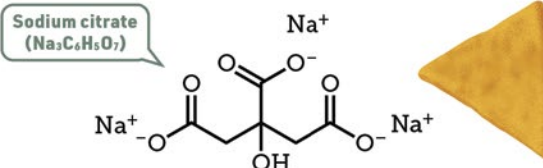
The product isomerizes to a ketosamine

Reactions form flavor compounds

Adding a bit of baking soda to frying onions increases pH. This accelerates the Maillard reaction, deprotonating amines so they react quicker with sugars, giving you golden-brown onions faster.

Make creamy nacho sauce easily

Melted cheese is delicious, but it starts clumping together as it cools. The secret to avoiding this is adding sodium citrate. Warming a mixture of cheese, water, milk, and sodium citrate creates a stable, smooth cheese sauce.



The sodium ions replace calcium ions that hold casein proteins in cheese together. This substitution allows the casein proteins to separate and act as emulsifiers, binding fat and water together.



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