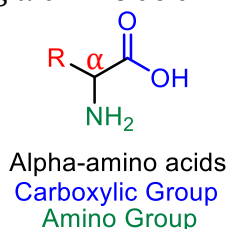
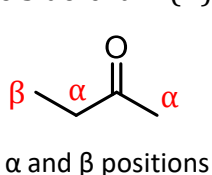




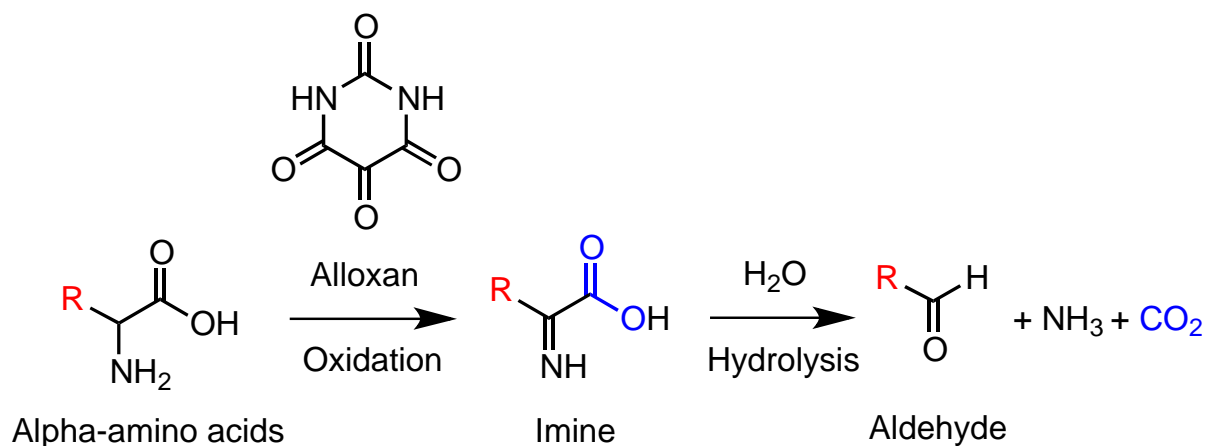
The Strecker Degradation Reaction

Alongside the Maillard reaction, the Strecker degradation (established in the 1960's) also plays an important role in the formation of flavour compounds. In raw foods, there are a large number of free amino acids and sugars; and, as we have seen, these are the starting reactants that fuel the Maillard reaction that occurs during cooking.

α -Amino acids can be the reactants in the Maillard reaction, or alternatively, they can undergo a Strecker degradation reaction. This reaction converts α -amino acids into aldehydes. α -Amino acids have both a carboxylic acid group and an amine group on the α -carbon, and an R group is typically used to indicate a side chain (for example, when R is methyl, the amino acid is alanine). The Strecker degradation produces an aldehyde (RCHO) with the same side-chain (R) as the starting α -amino acid.

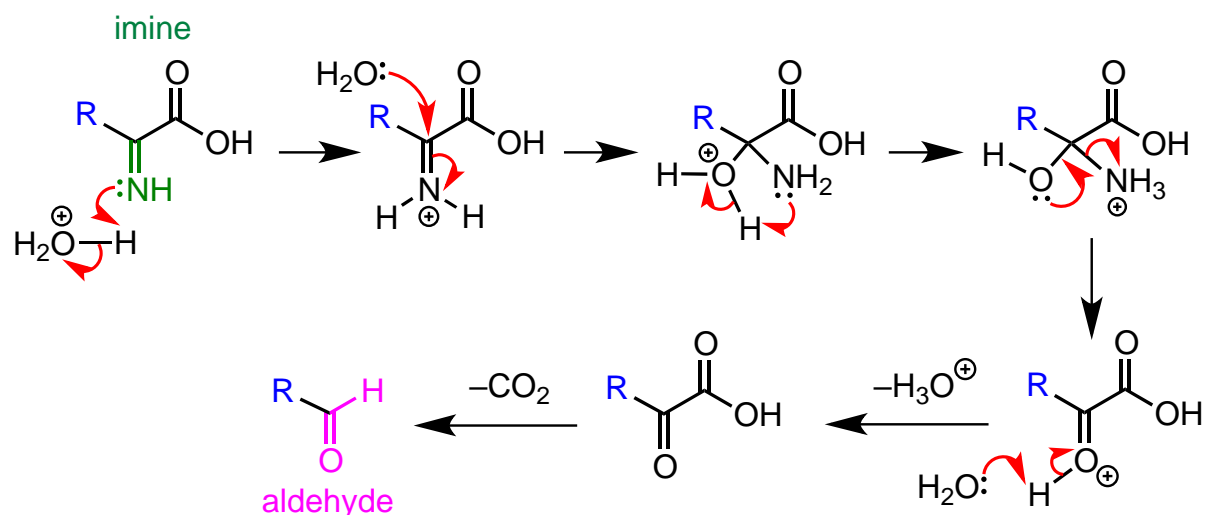


In the first step of the reaction (shown in the scheme below) the α -amino acid is oxidised to an imine (a compound containing a C=N double bond) – notice that the α -amino acid loses H_2 , hence, it is an oxidation reaction. An oxidising agent that can be used is alloxan, which has a six membered ring (with two nitrogen atoms and four carbon atoms – all of which have a double bond to an oxygen). The resulting imine can then be hydrolysed, by the addition of water, producing an aldehyde, ammonia and carbon dioxide, as shown.



The imine hydrolysis mechanism is shown below. The nitrogen atom donates its lone pair of electrons to the hydrogen atom of H_3O^+ , pushing the electrons from the O-H bond onto the oxygen forming a water molecule and a positively charged nitrogen. Following this, the lone pair from the H_2O is donated to carbon on the C=N bond, pushing the electrons from the C=N bond onto the nitrogen and forming a new C-O bond. A proton transfer then takes place, often shown by the lone pair on the NH_2 nitrogen abstracting a proton (H^+)

from the $^+OH_2$ group, pushing the electrons onto the oxygen atom. The lone pair from the oxygen can then be donated to form a C=O bond, resulting in a positively charged oxygen and kicking out ammonia as a leaving group. A H_2O molecule can then abstract a proton. Carbon dioxide is then lost forming the resultant aldehyde.



The compounds formed by the Strecker degradation have low odour and taste thresholds, this means that they only need to be present in low concentrations for their presence to be tasted. Therefore, products from the Strecker degradation, such as phenylacetaldehyde, which is the Strecker degradation product of L-phenylalanine, and has a flavour of honey, are very important for the final flavour of the food or drink.

