

Organic Synthesis

Alpha Amino Acids

- Amino acids contain both amino functional group (-NH_2) and carboxylic acid functional group (-COOH)
- Alpha amino acids are those in which both of these functional groups are attached to the same carbon atom (-C(COOH)NH_2)
- Alpha amino acids are building blocks of proteins or polypeptides
- Polypeptides are those which contain many alpha amino acids
- Dipeptides (contain 2 alpha amino acids), Tripeptides (3) and more exist
- Polypeptides are formed from bonds between -NH_2 functional group of one alpha amino acid and -OH group in another \Rightarrow -NH_2 loses 1 H and the -OH group is lost to form H_2O and a bond
- In the **solid** and **aqueous** form of an alpha amino acid, they occur in a zwitterion form
 - o Contains a positive and negative terminal (not to be confused with partial charges of a polar molecule) and overall neutral
 - o Weakly acidic -COOH group releases H^+ ion and is accepted by weakly basic -NH_2 functional group
 - Remaining groups are: -COO^- and $\text{-N}^+\text{H}_3$
 - o Formation of zwitterion explains why all alpha amino acids are crystalline solids with relatively high melting points \Rightarrow Zwitterions can form very strong ionic bonds with each other
 - o Alpha amino acids are fairly soluble in water
 - o Zwitterions are capable of behaving as acids (proton donors) or bases (proton acceptors) \Rightarrow K_a depends on pH of surrounding solution
 - o Zwitterions can also act as buffers and are amphoteric
- Carboxylic acids have acidic properties
- Hydrolysis:
 - o $\text{Carboxylic acid} + \text{H}_2\text{O} \rightleftharpoons \text{ethanoate ion} + \text{hydronium ion}$
- Carboxylic acids are typically weak acids

Fats and Oils

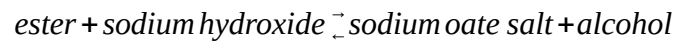
- Triglycerides \Rightarrow fats and oils (type of ester)
- Triglycerides contain fatty acid molecules attached to a main ester group
- Vegetable oils are unsuitable for cooking because they remain a liquid when heated
 - o Unsaturated fats from plants also tend to spoil quicker (due to more reactive double bonds, capable of addition reactions)
 - o Hydrogenation is solution \Rightarrow converts unsaturated liquid vegetable oils into more versatile solid products (ex. shortening, margarine)
 - Addition reaction where H atoms add to some double bonds in triglyceride carbon chains
 - Reduces degree of unsaturation and produces solid fat
 - Hydrogenation can produce an undesirable side reaction which converts some cis double bonds in triglyceride carbon chain into trans form

- Trans isomers are unsaturated, but their linear geometry increases dispersion forces and allows molecules to pack more efficiently than cis form
 - o Trans fats solidify more readily than cis \Rightarrow poses a risk to cardiovascular system

Zwitterions

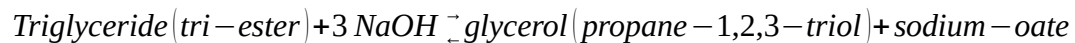
- α -amino acids exist as a dipolar ion in aqueous and solid solutions
- Carboxylic acid group loses proton, NH_2 group accepts proton
- pH and charge is neutral, zwitterion is capable of ionic bonding
- Therefore, α -amino acids are crystalline solids with high bps, due to ionic bonding
- Zwitterion forms cationic form (accepted proton) in low pH, as there are an excess of protons
- Forms anionic form (released proton) in high pH

Ester Hydrolysis



- Na^+ and O^- atom goes to oate salt, H goes to alcohol

Saponification



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