# Technical Question T11: Diastatic and Proteolytic Enzymes

My answer will be targeting around 400 words as that seems like an acceptable length from Hommel’s results.

Diastatic and proteolytic enzymes naturally occur in malt and are released during the mash at various temperature ranges of the mash. Enzymes are largely drawn from base malts. There is little to no enzyme activity in crystal or roasted malt since they are denatured by the process which makes them. Without enzymes we can’t get starches and sugars out of grain to make beer. This is why you have to be conscious of enzyme levels in your grain choices. You must have enough enzyme content to fully convert the grain bill in the mash. There may also be times when you have to mash longer due to lower enzyme levels in some base grains.(90 minute mash)

Proteolytic enzymes are active between 103 and 122F. They work on proteins, breaking them down in to smaller pieces called polypepides which are necessary for good head retention. They break down proteins further in to peptides and amino acids that are essential to proper yeast growth and development.

Diastatic Enzymes are active between 80 and 160F but we primarily worry about Beta Amylase(130-F-150F) and Alpha Amylase(149F-158F) Diastatic Enzymes work on starches by degrading them in to smaller starches(dextrins) and fermentable simple sugars.

Proteolytic enzymes primarily effect the finished beer by reducing cloudiness and aiding in head retention. The peptides and amino acid levels produced by this enzyme are critical to healthy yeast in fermentation which is critical in the path to cleanly fermented beer.

Beta amylase is directly responsible for how much fermentable monosaccharides(maltose, glucose) will end up in the beer. The more fermentable sugar is present, the higher the alcohol, the lower the final gravity. Beta Amylase does this by cleaving the small ends off starches. Complimentary to Beta Amylase, Alpha Amylase breaks larger starches to produce non-fermentable dextrins and starches. (the beta amylase will come behind and further reduce these where it can) These larger non-fermentable dextrins contribute to the overall body of the beer which can make the mouthfeel fuller and enhance head retention. The amount of time the brewer spends in different temperature ranges can sway whether the wort has the potential be more alcoholic, more full bodied and therefore effect the overall balance and quality of the finished beer.

# Technical Question T11. “Diastatic and Proteolytic Enzymes”

# Describe and explain the role of diastatic and proteolytic enzymes in the brewing process and how they affect the characteristics of the finished beer. Address the following topics:

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| **50%** | **Describe and explain the role of diastatic and proteolytic enzymes in the brewing process.** |
| **50%** | **Describe how they affect the finished beer.** |

**1) Proteolytic Enzymes**

*Works on:* Proteins.

***Optimum Temperature:*** 113-122 °F (active 103-122 °F).

**Describe/Explain:** \* Naturally occur in malt. \* In the mash, they degrade larger proteins in the malt into smaller proteins and amino acids. \* Typical protein rest ~120 °F for 15-20 minutes. \* Proteinase breaks down proteins into smaller fractions such as polypeptides, which are necessary for good head retention. \* Peptidase breaks down polypeptides into peptides & amino acids, essential for proper yeast growth & development.\* Highest enzyme levels in pale, fully-modified malts. \* No enzyme activity in crystal/caramel or roasted malts.

**Effects on Beer:** \* Reduces cloudiness. \* Aids lauterability of mash when using high-protein malts (e.g., wheat, rye). \* Aids head retention. \* Aids yeast health. \* Too long a protein rest (1+ hour) can reduce head & body. \* Insufficient peptides and amino acid levels can lead to poor yeast health, indirectly causing yeast-derived off-flavors (e.g., diacetyl, acetaldehyde, higher alcohols) and reduced wort attenuation.

**2) Diastatic Enzymes**

*Works on:* Starches.

**Describe/Explain:** \* Begin working when starches are gelatinized by being soaked and heated in the mash (temperature varies, usually 80-160 °F). \* In the mash, they degrade larger starches in the malt into smaller starches (dextrins) and fermentable simple sugars (e.g., mono & disaccharides). \* Naturally occur in the malt. \* Highest enzyme levels in pale, fully-modified malts. \* No enzyme activity in crystal/caramel or roasted malts. \* The two most important diastatic enzymes are Beta Amylase and Alpha Amylase.

**A)** **Beta Amylase (Optimum temperature range: 130-150 °F. Denatured above 154 °F):** \* Produces monosaccharides (e.g., maltose, glucose).\* Breaks off maltose units from reducing ends of starches by cleaving 1-6 bonds. \* Unable to quickly reduce large starch chains. \* Unable to reduce branched starch chains.

**Effects on Beer:** Creates more fermentable wort, thinner bodied beer with lower head fullness and retention.

**B)** **Alpha Amylase (Optimum temperature range: 149-158 °F. Denatured above 167 °F):** \* Breaks links from starches at random by cleaving 1-4 bonds. \* Produces short-chain starches and polysaccharides (e.g., dextrins).\* Unable to completely reduce branched starch chains. \* Aids action of beta-amylase by creating more reducing ends for them to work on.

***Effects on Beer:*** Creates more dextrinous wort, thicker bodied beer with higher head fullness and retention.

Remember

**M.A.L.T.** = More Alcohol, Lower Temperature.

**Beta Amylase:** It’s “beta” because it’s a “wimp” compared to alpha amylase. It can’t stand higher temperatures and it nibbles on molecule ends while alpha randomly tears apart big starch molecules. It’s also the “first act;” alpha amylase comes in afterwards to finish the action.