RESEARCH

# WHAT IS DIASTASE?

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Diastase is the common name for an enzyme called alpha amylase. The role of this enzyme is to break up complex carbohydrates like starch into smaller sugars that can be more easily metabolised. Bees add diastase to nectar during feeding, although as there is no starch in nectar, it is not clear why this function has evolved.

Bees have no way to remove diastase after it is added, and so it inevitably ends up in the resulting honey, where it is preserved for extended periods of time. This was first discovered in Germany in 1910. Shortly afterward it was realised that because diastase is deactivated by heating, it could be used an indirect measure of the freshness of a honey sample.

## What does a diastase test measure?

To understand what the diastase test measures and what the results mean, it is useful to have an understanding of how the test works. In brief, the honey is diluted in water, which releases the enzyme and allows it to perform its intended function. It is then fed starch, which the diastase breaks up into glucose molecules. The speed at which this occurs is measured, and is referred to as the diastatic activity. On a laboratory test report this can also be referred to as the diastase number or DN.

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A common misconception is that the diastase test simply measures the amount of diastase in honey. This is not strictly true, as the diastatic activity is reflective of multiple factors, the two major ones being the amount of diastase present in the sample, as well as the quality of the diastase.

## What are typical values?

The minimum diastatic activity which would apply to New Zealand honeys (as specified in Codex) is 8.0 DN, and this tends to be the level which overseas regulators want to see.

Freshly extracted honey which has not been heated or stored for any length of time is usually thought to have diastatic activity of around 20–30 DN. However, results in even freshly extracted honey are very variable, and while some honeys may be higher than this, many honeys may be lower. According to CODEX, certain honeys have a lower limit because of naturally low diastase levels—citrus being an example. At this stage there are no New Zealand floral types with an exception.

The average diastatic activity of honeys tested at Analytica has been found to be 8.7 DN, with many showing no activity whatsoever, but some reaching more than 40 DN. The distribution of values is illustrated in Figure 1.

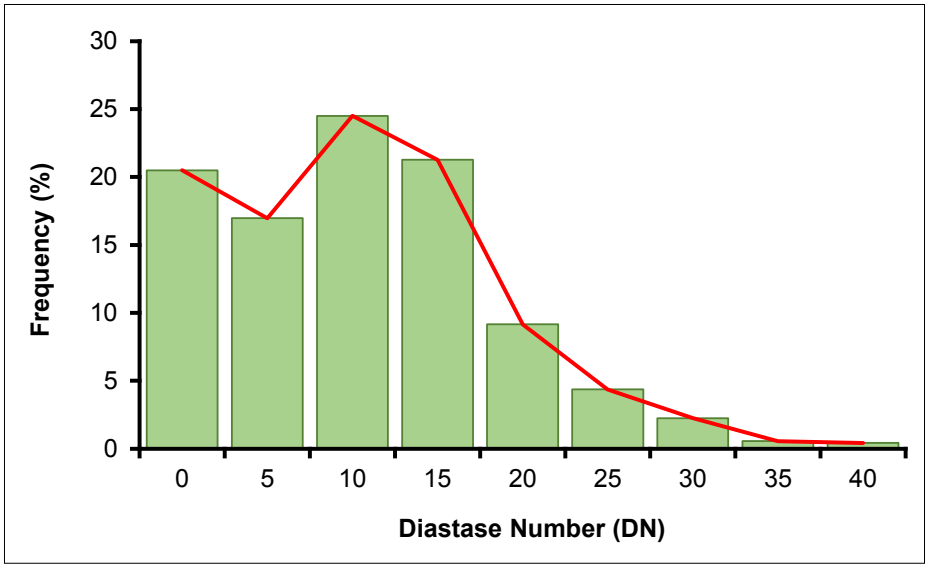


*Figure 1. Plot of the frequency of diastatic activity of New Zealand honeys tested at Analytica. Please note that this represents a range of different honey, from freshly extracted to older drums and packed production batches.*

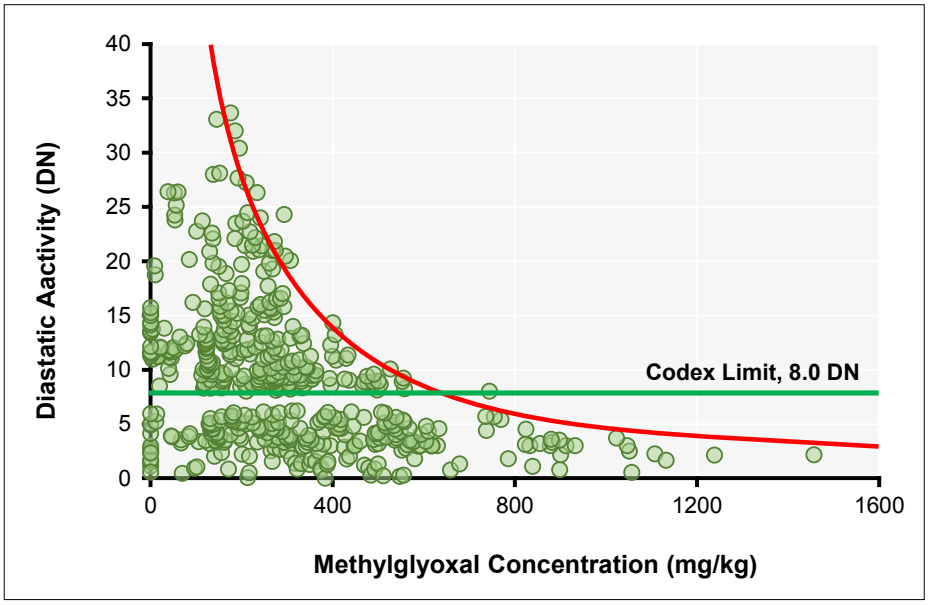


*Figure 2. Plot of diastatic activity (DN) compared to methylglyoxal concentration.*

## What affects the diastatic activity in a honey?

Enzymes are delicate. They are degraded by a great number of things, including heat, age, salt, acids, bases, and many more. Diastase is no exception to this rule, and in honey, is predominantly degraded by cumulative heat exposure.

Much like HMF (hydroxmethylfurfural), this degradation can occur rapidly at high temperatures or more slowly at lower temperatures. At 20°C, diastase is said to degrade by half over the course of several

years, though at 40°C this only takes a few months, and at 60°C may occur within as little as a week (White, 1994). Heating at 80°C for just two minutes destroys 20% of the diastase activity (Ajlouni & Sujirapinyokul, 2010).

A review of Analytica's test results for diastase to date reveal similar trends. We find that as a general rule, honeys with higher MGO (methylglyoxal) content tend to have lower diastatic activity. This is probably a coincidental relationship rather than a causal one, as high-MGO honeys tend to be aged for longer periods of time than those with less MGO, and consequently the diastase has longer to degrade during this storage period. This is summarised in Figure 2.

An interesting relationship can also be seen between the diastatic activity and the HMF concentration, which is more directly related to the age of the honey. When the HMF is very low (<5 mg/kg) two-thirds of honeys have enough diastatic activity to be compliant with the Codex limit of 8.0 DN. As the HMF increases toward 40 mg/kg the proportion of compliant samples reduces essentially to zero, as shown in Figure 3.

Since diastase testing is far less common than many other tests, these results are likely to be reflective of the natural behaviour of diastase in honey, without the added effects of blending specifically to achieve certain diastase levels. As the test becomes more prevalent and the diastase content of honey is more actively managed, it is likely that we will see some modifications to these trends.

## What affects the amount of diastase present?

Several schools of thought exist about why certain honeys may have more or less diastase than others. It has been proposed that high-sugar nectars may give rise to low-diastase honeys because they require less manipulation by bees in order to convert them to honey (White, 1994), or that different species of bees may produce different amounts of diastase (Vit, Bogdanov, & Kilchernmann, 1994). All in all, it is not nearly as well understood as the quality, since there are no analytical methods for directly measuring the amount of diastase in a particular sample.

## A few thoughts about when to test for diastase

Some New Zealand companies have been testing for diastase in honey for many years, because of the markets they export to. Others have hardly heard of it. Your choice about testing will be based on the market to which it is likely to be sent.

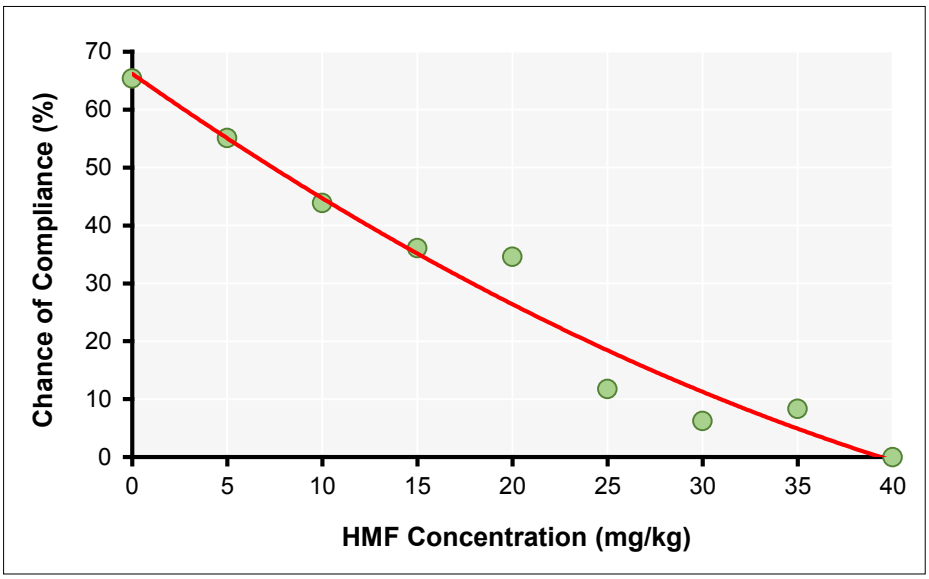


*Figure 3. Plot of the proportion of honey samples tested which are compliant with the Codex diastase limit compared to HMF concentration.*

The test is particularly important for mānuka honey, which tends to be stored for a longer period of time than other floral varieties of honey. Given the wide variability in diastase test results seen in even freshly extracted honey, having a result for a batch at the point of extraction is very helpful. Honey with potential to develop into a higher grade monofloral mānuka, which also has a high diastatic activity, has the potential to be very valuable to a processor if carefully stored as it matures.

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## Conclusions

The diastase test measures how quickly a particular enzyme present in honey can cleave up starch molecules. While this function presents no intrinsic value, the activity of enzyme is reduced by heating, and so it can be used as a quality parameter. The diastase content of honey is not actively managed by many companies, and as a consequence, approximately half of the honey tested at Analytica is not compliant with the minimum diastatic activity of 8.0 DN.

## References

Ajlouni, S., & and Sujirapinyokul, P. (2010). Hydroxymethylfurfuraldehyde and amylase contents in Australian honey, *Food Chemistry, 119*(3), 1000–1005. doi:10.1016/j.foodchem.2009.07.057

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