

# VDK Test

## What Are VDKs?

Vicinal Diketones (VDKs) are an organic group of flavour components in beer. Most notably 2,3-butanedione (diacetyl) and 2,3-pentanedione.

Sweet butter, caramel, or butterscotch flavours and aromas are characteristics of diacetyl, while pentanedione contributes more honey-like notes to beer.

Both compounds are formed during the early and mid-stages of beer fermentation. However, the detection of diacetyl in a finished beer can also be a result of yeast stress from high fermentation temperature and aeration levels, bacterial contamination, even the yeast strain.

## How Do I Test My Beer for VDKs/Diacetyl?

The following process highlights how to test your beer for VDKs/Diacetyl in your fermented beer:

1. Take a 60 - 100 ml sample of your beer from the sample port on your FV.
2. Put the sample in a water tight and microwave safe container. (Tupperware or similar).
3. Microwave the beer with the lid loose - warm the sample to about 75°C – DO NOT boil the sample.

NOTE: If you accidentally boil the sample, dump it out and start over, from point 1.

4. Secure the lid of your warmed sample, submerge it in a bowl, or sink filled with 80-90°C water for 30 minutes.

NOTE: Step 4 simulates rapid ageing and will convert any VDK into diacetyl.

5. Once the beer has been kept warm for 30+ minutes (aim for 76-80°C), then chill it to room temperature and taste.
6. If the beer has no detectable buttery character and/or slick, silky mouthfeel (or any other characteristics of diacetyl), you can drop the beer temperature and/or package it up.
7. If there is a buttery character, allow for a few more days of maturation at room temperature:
  - a. If you have a flocculant yeast, give your fermenter a shake to rouse some yeast back up into suspension. This will help speed the removal of the diacetyl.

Repeat this process until you have a clean final product.

## More About VDKs

Although VDKs are formed during fermentation, they are not produced directly by yeast. Instead, they are the result of a long-chain reaction\*, which is a precursor to VDKs. Levels peak around halfway through fermentation.

[\*During synthesis of the amino acids valine and isoleucine, yeast cells excrete alpha-acetolactate (aceto-lactate) and alpha-ketobutyrate (ke-to-butyrate).]

Subsequently, the long-chain reaction breaks-down spontaneously into VDKs, with levels peaking near the end of fermentation.

Once your beer hits terminal gravity, the yeast enters the maturation stage and VDK levels decrease. This is when the yeast metabolises VDK compounds as an energy source, converting them into less flavour-active molecules, namely acetoin and then 2,3-butanediol. Acetoin and 2,3-butanediol have high flavour thresholds, so are difficult to detect - neither contributes much in terms of flavour.

If you remove the beer from the yeast before reabsorption is complete, you risk VDKs later appearing in the finished beer.

## Diacetyl Rest

It is important that following fermentation, you give yeast time to clean up unwanted compounds in the beer.

Once your beer reaches terminal gravity, and fermentation is complete, it's usually better to rest the beer above 18°C for 48 hours.

Crash Cooling too soon, leads to fermentation pre-cursors remaining in the finished beer.

Stopping fermentation early does not give the yeast chance to metabolise off-flavour and aroma compounds during the maturation stage. This will lead to you needing to take additional action or give your beer an extended conditioning time to remove diacetyl.

## Detecting Diacetyl

Modern science says that up to 25% of people are blind to detecting diacetyl. Others have varying levels of ability from hyper sensitivity to lesser superpowers.

# Diacetyl Exhibiting in Your Beer

Diacetyl typically shows up in a beer that a brewer has not left on the yeast long enough for it to clear up fermentation precursors (VDKs). However, diacetyl can also exhibit in your beer through oxidation or microbial infection.

## Diacetyl by Oxidation

One of the amino acids produced by yeast in the early fermentation stages is valine. An intermediate compound in valine production is called acetolactate. Not all the acetolactate produced eventually becomes valine; some will leak out of the yeast cell and into the beer and is then chemically converted to diacetyl. The chemical reaction occurs through oxidation, with high fermentation temperatures being a popular cause of this reaction. The higher the temperature, the more acetolactate is converted into diacetyl.

Valine is a nutrient used by the yeast, used during the lag/growth stage. Valine can be provided by malt and levels vary (malt dependent) but if there isn't enough present, the yeast produces it itself. The more valine yeast produce, the more acetolactate intermediate is required, and hence the more diacetyl made.

## Diacetyl by Contamination

Diacetyl can exhibit in your beer via microbial contamination. Lactic acid bacteria: *Pediococcus* and *Lactobacillus* contamination can come from one or more point of contact or poor sanitation practices during packaging i.e. dirty hoses, bottles, connectors etc.

Lactic acid bacteria all produce diacetyl. These bacteria have historically been notorious contaminants and beer spoilers. They are anaerobic and tolerant to alcohol and heat. This means they're happy to live in your beer. The diacetyl produced by bacteria is far from pleasant and can taste like sour butter.

Homebrewers can have a difficult time bottling beer in a manner that eliminates lactic acid bacteria. This is one reason great-tasting beer can be bottled, only to develop pressure, sourness, and diacetyl off flavours in as little as two months.

Bottle conditioning with some yeast left in suspension can help you to reduce diacetyl in this instance. The yeast won't kill bacteria, but it will reduce any diacetyl produced from oxidation of acetolactate in the bottle.

## Choose Your Yeast Strain Carefully

There is a strain-specific phenomenon with the amount of valine produced. Because given the same conditions as above i.e. yeast producing its own valine, different strains produce different levels of diacetyl.