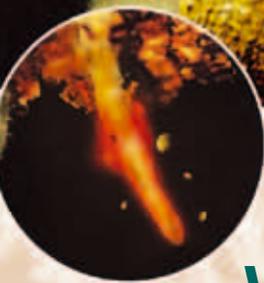


# ENZYME TWO-STEP TEST

# DIY



## Which enzyme products work?

by: Ir. D. Kroeze, CANNA Research

During their life, plants are continuously making new roots and roots are constantly dying off. This process of dying off doesn't just form a source of infection for diseases; valuable space is taken up by the dead roots instead of air. Enzyme products are used to break down these dead root cells. In addition to creating more air space, the plant can also absorb the nutrients that are released. An additional advantage is that the substrate currently in use for cultivation can be used again. These enzyme products have additional properties as well.

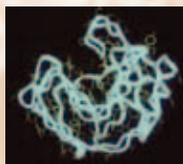


products; consider the preparation of bread, cheese or beer for example. Enzymes that are used in cultivation must, in any case, be capable of breaking down plant remains. Plant remains are made up of cells that are joined together with a kind of glue known as pectin. If you want to break down the remains, the glue between the cells has to be broken down and the cells broken into pieces. A wide range of enzymes are needed for this, two of which are indispensable. The first

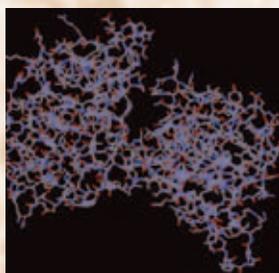
enzyme dissolves the glue between the cells while the second enzyme breaks the cell walls into pieces. These enzymes are mainly involved in doing the rough work. Other enzymes are needed in addition to these two, but without these two enzymes an enzyme product simply will not work. If you want to know if these enzymes are present in the product that you use you can perform the following simple tests using items that you can buy in the supermarket. If the results of both tests are good it means that both enzymes are present and that your product is actually capable of breaking down dead plant remains.

### THE TESTS: TWO-STEP TEST

You don't need a laboratory to know if the brand you have purchased works. You already have everything you need at home or you can buy it at the supermarket. In order to determine whether or not the enzymes you have brought are capable of breaking down plant remains we are going to carry out two



tests: the two-step test. Read the text thoroughly before you begin the tests to be sure that you have everything you need and that you know in advance what you are going to do. Follow the step-by-step instructions in the order given. Within a day you will know if your product works.



**What are the enzymes and how do they work exactly? Enzymes seem to be a type of intangible substance that can only be detected with the use of the correct laboratory equipment. This leaflet explains how you can detect enzymes yourself, simply and at home, so that you can determine whether or not your product contains the correct enzymes.**

### WHAT ARE ENZYMES?

Enzymes are proteins that have a very special function; they can both build up and break down substances. Each enzyme has a specific function and generally speaking, they can only build up or break down one type of substance. If an enzyme does this, and it is not used up, it can stimulate the same reaction thousands of times. Our world would look very different without enzymes. Enzymes are used in making innumerable

## Step 1 The paper test

The first test of the two-step test we determine whether or not the enzymes you have bought are capable of breaking down the cell walls of dead plant cells. You can do a test to determine whether or not the enzymes you have bought are capable of breaking down the cell walls of dead plant cells. You can do this test using common-place materials; you will only need beakers (cups) and a piece of paper. It is preferable to use thin, white paper. A writing pad is perfect but you can also use thin printer paper. Newspaper and brown coffee filter paper are not suitable and tissue paper is too thin.

### The scientific basis for the paper test

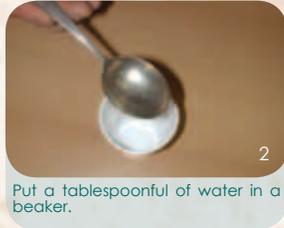
Paper is made up of cellulose. The cell walls of plants are also mostly

made up of cellulose. In other words, if paper can be broken down by the enzyme product it can also break down cell walls to a large extent. The beaker that contains water is used to show that water doesn't cause the paper to disintegrate. If the paper fails to disintegrate in the enzyme product very well, it may be that the paper is a little too thick. Try again with different paper using a piece from the copier for example.

If the paper doesn't disintegrate then you do not have to carry on with step 2: The apple sauce experiment. If your enzyme product can not break down cell walls it does not matter if it can remove the glue because the problem cellulose will remain. Then your enzyme product doesn't work. You can determine this with one simple test.



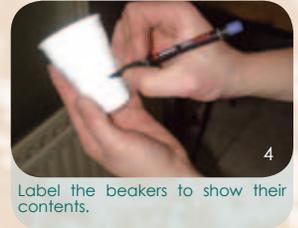
1 This is what you need.



2 Put a tablespoonful of water in a beaker.



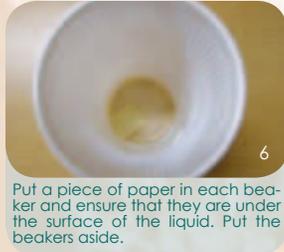
3 Put a tablespoonful of the enzyme product in a second beaker.



4 Label the beakers to show their contents.



5 Cut two 1 inch pieces out of the paper.



6 Put a piece of paper in each beaker and ensure that they are under the surface of the liquid. Put the beakers aside.



7 Agitate the beakers after 12 hours.



8 The product is capable of breaking down cell walls if the piece of paper completely disintegrates like a sugar cube.

## Step 2 The applesauce experiment

You only need to carry out the applesauce experiment when the paper in the first test totally disintegrates. When it dissolved you can be sure that your product is able to break down cell walls of dead plant cells. A second, different kind of enzyme is needed to make sure that it will happen in your substrate as well, one that can separate cells. Luckily, you don't need a microscope to find out if your enzyme product can separate cells. You can probably find what you need in the kitchen: a measuring jug, a funnel (if you don't have one you could possibly use the funnel from the coffee machine), a dishtowel, a jar of applesauce, a table spoon

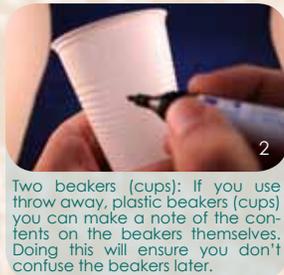
and some beakers (if you use throw away, plastic beakers (cups) you can make a note of the contents on the beakers themselves). Follow the sequence for working that is given below exactly! Instead of applesauce you can also use tomato ketchup.

### The scientific basis for the apple sauce experiment

Apple sauce consists of both juice and clusters of cells. When these cells are separated from each other the apple sauce becomes thinner and there will be more juice. This is why more juice is collected when using enzymes than when using plain water.



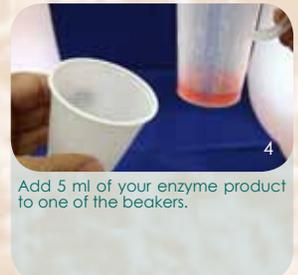
1 This is what you need.



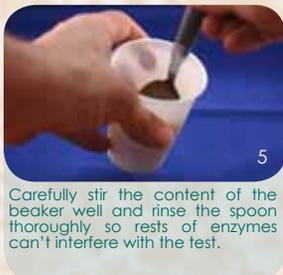
2 Two beakers (cups): If you use throw away, plastic beakers (cups) you can make a note of the contents on the beakers themselves. Doing this will ensure you don't confuse the beakers later.



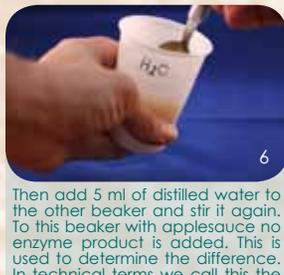
3 Put 100 ml of applesauce in all beakers. Make sure each beaker has exactly the same amount of apple sauce. If possible use a measuring jug.



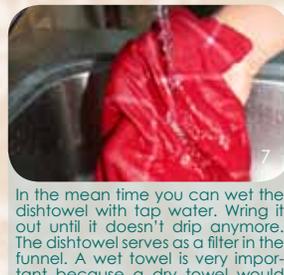
4 Add 5 ml of your enzyme product to one of the beakers.



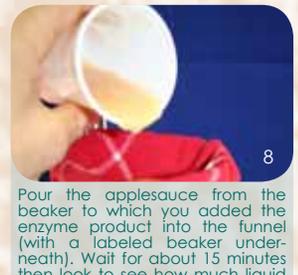
5 Carefully stir the content of the beaker well and rinse the spoon thoroughly so rests of enzymes can't interfere with the test.



6 Then add 5 ml of distilled water to the other beaker and stir it again. To this beaker with applesauce no enzyme product is added. This is used to determine the difference. In technical terms we call this the "control". Let the beakers stand for 15 minutes (not in the fridge).



7 In the mean time you can wet the dishtowel with tap water. Wring it out until it doesn't drip anymore. The dishtowel serves as a filter in the funnel. A wet towel is very important because a dry towel would absorb almost all liquid from the applesauce-enzyme-blend. Obviously it will influence the test.



8 Pour the applesauce from the beaker to which you added the enzyme product into the funnel (with a labeled beaker underneath). Wait for about 15 minutes then look to see how much liquid has passed through the towel. Clean the towel intensively when you want to repeat the steps. Do the same with the beakers if you want to reuse them.



9 The final result: If your enzyme product works properly the beaker with the applesauce-enzyme-blend contains more juice than the water beaker. When the enzyme beaker looks like the water beaker it doesn't work or works badly.