The effect of bead size on the activity of immobilised yeast enzymes essay sample...

Literature, Russian Literature

Enzymes serve as biological catalysts and as a result increase the number of reactions occurring within in a set period of time. To a similar effect yeast can be used to increase the rate of a reaction. It is possible to immobilise yeast using a solution such as Sodium alginate. This allows several usage's from the same enzyme batch and it also increases it's own stability. This technique is often seen in use in industry, one example of this is that seen in the textile industry.

Yeast uses Sucrose as a form of energy, and can then hydrolyse it internally and brings out its constituent monosacharides. Using this, it is possible to investigate whether the size of the yeast beads affects the reaction, which takes place. In theory, the greater the surface area of the beads, the slower the rate of reaction as less of the Yeast selectively permeable membrane are outward facing in order to further the reaction. Consequently the smaller the bead the faster the Sucrose is Hydrolysed yielding more of it's constituent monosacharides.

This idea is simply measurable, as it is possible to strain the sucrose through the beads, and test this residue for the presence of Glucose with test strips to collate the amount of Glucose. Sucrose is a disaccharide, consisting of one alpha-Glucose and one Beta-Fructose molecule joined in a condensation reaction. When these join an alpha 1-2 Glycosidic is formed, as the carbon atom 1 of the Glucose joins with the carbon atom 2 of the fructose. Sucrose Formation; There are no free carbonyl groups, and consequently Sucrose is a non-reducing sugar.

Yeast is able to internally break down this Sucrose. And use it in order to respire. The Glucose and fructose are separated in order to obtain energy. This is done via hydrolysation, demonstrated above. A water molecule is added in order to break down the connective Glycosidic bond between the Glucose and Fructose. This is the reverse of a condensation reaction. Recent discoveries have formulated mass industrial enzyme immobilisation. To immobilise a substance, it involves it being changed from a water-soluble state, which is mobile to an immobile water-insoluble condition.

This immobilisation is conducted in four ways. Immobilisation Techniques; Sodium alginate serves to encapsulate a yeast molecule(s). It forms a membrane upon contact with the yeast. As a result of this it is possible to vary bead size purely by varying the size of the syringe, which place the droplets in the solution, this allows a simple method of varying bead surface area, and producing more beads as a consequence.

From here I was able to conduct a preliminary investigation as to the strength of the sodium alginate solution required. sing previously collected data from the other immobilised enzyme investigations and studying a 0. 5%, 2% and 10% solution I found that the most acceptable concentration was 2%. Yeast itself is a Fungus, and its most common form is in brewer’s yeast, used in the formation of alcoholic beverages. It is unicellular, as it carries out the characteristics of life within itself. Yeast is capable of selectively taking in and ejesting substances through a selectively permeable membrane.

The cell is seen as simple internally, a nucleus, cytoplasm surrounded by a non-living cell wall, and selectively permeable membrane allowing substances to be engulfed or ejested depending on it’s necessity in the cytoplasm is where the Sucrose is passed, and is hydrolysed, alongside many other reactions taking place. New material can be added for growth, and budding carries out production. The Hypothesis; Yeast can be used to break down sucrose to its constituent monosaccharides, if yeast were to be immobilised it would become more stable, hence it would be easier to separate from the hydrolysed sucrose.

The smaller the surface area of the beads, the larger the resultant surface area, and consequently the larger the yield. This is possible to test by varying the bead surface area, and straining Sucrose through them in order to observe whether this hypothesis is provable. The plan continued; The apparatus chosen is best suited to the needs of the experiment. The syringes allow a simple method of varying bead size. The calcium chloride solution allows beads to be formed quickly. Distilled water prevents any extra-chemicular interference.

The Glucose test strips provide swift and accurate readings: muslin is used to prevent clogging in the straining process, no beads can block or travel through the bottom of the test syringe. The beakers used are neither unnecessarily small nor excessively large, and are suited to their intended use. Meticulous attention to safety should be observed at all times. Each chemical is to be kept separately at all times and also clearly labelled. The

sodium alginate can be irritant to the skin and appropriate warnings should be included.

Non of the chemicals should be handled directly and all glassware should be kept in a sensible location. Unused solution should be kept away from the test area and eventually disposed of with all the equipment cleaned with extra care. The beads should also not be handled directly when they are not in use. Safety equipment should be worn constantly such as goggles and any appropriate equipment including spatulas for handling are also important. Care should also be taken in solution preparation to keep all chemicals labelled and separate, as well as being made in controllable environments.

The changing variable is bead size to try and prove the hypothesis however, at a constant will be the temperature of the room for the duration of straining or draining. 5 minutes before testing as used and as the amounts of solution used in each case alongside the amount of time each bead set is used. In order to asses the amount of sodium alginate required to provide adequate beads for my test, a preliminary investigation as to which concentration was sufficient. As a result I concluded from these results that a 2% solution was viable.