**Ethanol from Substrate Music Video**

**1. Read the following**

**What are Enzymes?** Enzymes are non-living protein molecules that are present inside all living things – people, animals, plants, you name it. They are nature’s own tools, cutting and pasting different kinds of biological material and speeding up chemical reactions. And each enzyme has its own specialty. Human digestion is one of the many different processes helped along by enzymes in our saliva and stomach. They help to break down food so that your body can absorb all the nutrients. But enzymes can do much more than just help to digest food. They are currently used by more than 40 industries to improve manufacturing processes and product performance.

**Real‐world Applications**

Enzymes have the potential to help solve some of the world’s most pressing challenges, including the economic and environmental challenges of reducing CO2 emissions and overcoming resource scarcity. By lowering energy consumption in turning waste products into advanced biofuels, or producing detergents that can clean in cold water, enzymes can contribute significantly to reducing the world’s energy use. Enzymes have minimal environmental impact because they are naturally biodegradable. Estimates show that manufacturers using enzymes save an average of 100 kilograms of CO2 emissions for each kilogram of enzymes they use in their manufacturing process.

**Biofuels**

Novozymes (a local biotech company) produces enzymes that convert the starch and cellulose in various feedstocks like corn into simple sugars, which in turn can be fermented into biofuels. Every day, Novozymes gets closer to developing technologies that will enable more types of agricultural and urban waste to be converted into commercially-viable advanced biofuels that can reduce greenhouse gas emissions by up to 90 percent when compared to gasoline.

**2. Go to** [**www.iamlodge.com/beans/?cat=37**](http://www.iamlodge.com/beans/?cat=37)

 Watch the first 2 minutes of the video with your headphones on!

**3. Read the lyrics: *Ethanol from Substrate***

*(Stanza 1)*

Corn is pounded into flour in a hammer mill

Mix in the water and the enzyme ‘til the tank is filled

Add a touch of nitrogen mm

For the yeast to be strong and heal

185 Fahrenheit – degrees

substance, thick with a high viscosity

now it starts to break down

smaller starches have been broken free

thinned and pumped to a tank for the liquefaction

this cooked corn mash is a stage

for some enzyme action

*(Chorus)*

alpha amylase

don’t stay in the tank too long

cause you shake during liquefaction and break

down starches to smaller shapes

saccharify & ferment

the glucoamylase kicks out simple sugar and tastes

like a real imitation steak

to the yeast that eat their weight

gettin ethanol from substrate

*(Stanza 2)*

Cool down the liquid to 90 Fahrenheit degrees

Pump it outta there and put it into one of these

Yes fermentation, please

This glucose heavy feast

Glucoamylase is added to the mix

to create and satisfy the sugar fix

Then the yeast is added

To eat the glucose - all of it

Thinned and pumped to a tank for the fermentation

This cooked corn mash is a stage

For some enzyme action

*(Stanza 3)*

Then we separate with a centrifuge

It’s looking great at 190 proof

With the molecular sieve, the final water leaves

And that 5% is history

**4. Choose either one Stanza or the chorus and make signs to represent the words (like in the example video). Do internet research to learn about words you might not know the definition of.**

**5. Record your stanza or chorus in a one-take video by playing the song on someone’s computer and using your signs to represent the words. Use body movement to enhance your music video.**

We will put them together into a music video that everyone will watch next week!

www.youtube.com/watch?v=dU\_9cU8Rvfo&feature=youtu.be