M13 Innovation

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The large amounts of CO^2 in our air are causing climate change to get more and more extreme everywhere on the earth. Now we beg the question, where exactly does most of this CO^2 output come from? The answer is factories and power plants that burn fossil fuels. You may think the problem could be caused by volcanoes, but in 2011, humans put out 29 billion tons of CO^2, while volcanoes, depending on their activity, put out 65-319 million tons. Coal fueled power plants are emitting way to much CO^2 into the air. In 2012, about 33 billion tons were pumped into our atmosphere. In the year of 2009, the US put out only 7% of the world's CO^2 emissions. China accounts for 13%. The world has and will continue to build more and more factories, thus causing the CO^2 emissions to sky-rocket, and CO^2 will keep infecting the earth's atmosphere, building up until find ourselves in the situation of the planet being uninhabitable. We cannot allow ourselves to ruin the climate more then we already have. If we do, positive feedback loops will speed up the global warming process, and we may tip the scales past the point of no return. Why do we keep poisoning ourselves and our planet? That answer is simple, we enjoy the comforts of electricity, and with the production of electricity comes the side effect of CO^2 output. Now you may be thinking, we could simply convert to a more eco-friendly power source such as solar, wind, and hydroelectricity, but most companies that produce electricity don't do this because it's inefficient. Fossil fuel plants can store much more electricity than solar panels or wind turbines right now. The M13 bacteriophage can fix that situation by simply allowing us to upgrade our batteries.

As you can see, fossil fuels will kill us, the planet will keep experiencing the greenhouse effect, and cause weather patterns to change. But, we can use the M13 bacteriophage to make batteries more effective, but how? Using biological materials, it is possible to have more Nano-scale sized particles, the most effective of these biological materials is the M13 virus. M13 is a filamentous bacteriophage that is a single strand of DNA and six proteins, five of which are coat proteins. Before the M13 virus, we used the SWNT to improve lithium ion

batteries, this is a complex of viruses to replicate M13. This was not as effective as the M13 virus was alone in improving battery capacity. As an added bonus, SWNTC was drawn from blood, whereas M13 is not, thus giving less opportunity for the spread of disease and personal safety. Another problem with the SWNTs is that they do not help in converting electricity, they increase the collection of solar energy, and only solar, but they do not help in converting electricity, whereas M13 does. When you start the chemical change needed to make the M13 virus more efficient, we apply lithium, and then let it react to the air around it. The bacteriophage does not need to have pure oxygen, it filters out the excess material by itself. When it is done reacting with the air, the M13 bacteriophage becomes conductive. Then, we can apply the M13 bacteriophage to the small wires inside of the lithium air battery, currently the best battery for its price, size, and efficiency, these wires can get two to three more times the energy density of their current capacity. Don't believe us? Go here…http://newsoffice.mit.edu/2013/better-batteries-through-biology-1113or for the raw data and research http://dspace.mit.edu/handle/1721.1/82172

Now that you know the M13 bacteriophage will work, I bet you're wondering how we are going to incorporate this into real life. Don't worry, we've got a plan. We plan to have solar power plants use these M13 batteries to store more power, and store more electricity on average. It will store more electricity that was produced after the sun goes down, or in the case of wind power, the wind stops blowing. Also, M13 can be used inside of solar panels to make them more efficient in producing electricity. The bacteriophage does this by speeding up the process of turning sunlight into electricity. Another use could be car batteries, we can incorporate M13 into these car batteries to increase efficiency in vehicles. This bacteriophage could also be used in phone batteries, (most phone batteries are lithium air batteries) making them last longer. Batteries in general could also be drastically improved.

We predict that this will have a huge impact on our society. We can't stop the greenhouse affect completely, but this will slow it greatly. The M13 virus will do this by being implemented into solar and wind plants. The solar and wind

plants will be able to store more power, and solar production will be boosted, thus making solar and wind more popular because they are clean and relatively cheap. This will eventually convert the main power source to solar and wind, thus reducing CO^2 emissions from power plants. This is because coal and oil are starting to run out, and are becoming more expensive, people will start to choose the cheaper solar and wind power. For our other M13 ideas, such as the car battery and the normal battery, this will make electronics and cars longer lasting and efficient.

As you can see, the M13 bacteriophage will greatly improve our lives and help with the growing problem of CO^2. By utilizing M13's biological properties, we can create a much more effective type of battery. This battery can be used in renewable source power plants, by helping them store more power. As an added bonus, M13 can help solar panels convert more sunlight into electricity. These new and improved power plants will become our main source of power, reducing CO^2 emissions greatly. This solution is feasible, because much research and testing has been done and it has been proven that the virus can improve electrical capacity, all we have to do is apply this research and testing to power plants.

Sources: MLA format

Xiangnan, Dang. "M13 Bacteriophage-enabled Assembly of Nanocomposites : Synthesis and Application in Energy Conversion Devices." DSpace@MIT:. Massachusetts Institute of Technology, 2013. Web. 7 May 2015.

Morello, Lauren. "Global CO2 Emissions from Fossil-Fuel Burning Rise into High-Risk Zone." Scientific American Global RSS. ClimateWire, 3 Dec. 2012. Web. 7 May 2015.

"Which Produces More CO2, Volcanic or Human Activity?" Which Produces More CO2, Volcanic or Human Activity? 15 Feb. 2007. Web. 7 May 2015.

Chandler, David. "Better Batteries through Biology?" MIT News. MIT News Office, 13 Nov. 2013. Web. 7 May 2015.