TECHNOLOGY SCIENCE JOURNAL FOR TEENS

Can we use bacteria to make renewable rocket fuel?

TEACHER'S KEY
UPPER READING LEVEL

Check your understanding

1 How did we use genetics in our study?

Answer

We used genetic analysis to find out which bacterial genes could produce POP molecules. We then made more of these genes to enable us to produce high quantities of these POP molecules. Teachers should note that we used a DNA replication method called polymerase chain reaction (PCR) in our process that is not discussed in the article text. If you have talked about PCR with your classes it might be a good chance to talk with students about how the method is used in research studies like this one.

2 Why is it significant that our POP biofuels might be even higher energy than traditional high-energy fuels used in jets and rockets?

Answer

Having higher energy means that vehicles could go further on a single tank, or less fuel would be needed for rocket launches – making them more efficient and saving more space and weight for cargo. Requiring less fuel also further cuts down the environmental impact of these POP biofuels compared to traditional high-energy fuels.

3 Why will high-energy biofuels become increasingly important in the future?

Answer

The demand for fossil fuels from things like personal vehicles and heating our homes is going to go down as renewable energy replaces fossil fuels for these applications. This means that the proportion of fossil fuel usage for applications which need high-energy fuels (like shipping, aviation and rocketry), will increase. Our current battery technology isn't good enough (not enough storage capacity and too heavy) to make renewable electric energy sources an effective option for long aviation endeavors. Also, the demand for space travel could also increase, making this a bigger use of high-energy fuels. So, it's important that we find sustainable alternatives to petroleum-made high-energy fuels as soon as possible.

4 Look around the room you are in. List as many objects as you can whose production relies on fossil fuels.

Answer

Almost endless possibilities! Any plastic items used fossil fuels to create the petrochemicals used in plastics. Any item which uses electricity (a lamp, a mobile phone, or even an electric car) probably uses fossil fuels to power it, unless the energy comes from renewable sources. Any items of food in the room used fossil fuels in their production (e.g. from agricultural machinery or transportation).

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5 With a partner or small group, brainstorm ways that your school can reduce its fossil fuel use. Then write a letter to your school board sharing your ideas!

Answer

Answers will vary. One major way a school uses fossil fuels is the way the building is powered – most of the time, energy is made using oil and gas! So, you could encourage your school to go "green" by installing solar panels, or even small wind turbines, to generate its own renewable electricity instead. Another big use of fossil fuels is food – the way we make it, how we transport it, and even what we store it in! You could suggest to your school that the cafeteria serve local, seasonal food, instead of food that has had to travel a long way (using fossil fuels) to get there. Cutting out red meat is also a great way to reduce fossil fuel use, because raising cows is energy-intensive, and produces a lot of greenhouse gas! Your school could also reduce or eliminate single-use plastics, like disposable cups and plastic packaging, to reduce the amount of fossil fuels used in creating these plastics. Finally, you could help your school organize a campaign to encourage the community to share resources: carpooling, riding bicycles to and from school together, and passing down used backpacks, jackets, and books from siblings or other older students.

What type of fuel has the densest energy?

Answer

The POP biofuel we made in this study.