Experiment 3: What particle size produces the most effective suspension?

Mission brief:

Astronauts need to be protected using the best blockers of UV light. Scientists have discovered an ingredient that has many uses including protection from harmful UV light. It is called titanium dioxide. It's a white powder that doesn't dissolve in water or oil, is highly reflective and often used in paints and sun creams.

Titanium dioxide can be spread over smooth or uneven surfaces because when it's mixed in oil the insoluble solid particles are dispersed evenly so the oil can be applied to a surface. However the oily mixture can separate out over time.

Mission objective:

Determine the best particle size for making a long-lasting suspension.

Mission directive:

Use different types of sugar (a cheaper alternative to titanium dioxide) to investigate the best particle size for a suspension.

Method

1. Examine the sugar samples and list them in order of particle size (largest to smallest) on the results table.
2. Predict which of the sugars will stay in suspension for the longest time after stirring.

   The sugar that I predict will remain suspended for the longest time is

   .....
3. Measure 100ml of vegetable oil into a transparent cup.
4. Starting with the largest sugar grain, add one teaspoon (5g) to the cup. (To be consistent each time, make sure it is a level measure.)
5. Stir the sugar in the oil for 20 seconds.
6. Start the timer and measure how long it takes for all the sugar particles to fall below the black line.

   TIP: for smaller sugar particles, the initial mixture looks cloudy but will fall below the line eventually.

   (NB stop after 10 minutes if the particles are not all below the line – record this as 'stable'.)
7. Record the time in the results table.
8. Repeat steps 3–7 (with a clean cup and fresh oil) for the remaining sugars.
9. Post your results to **http://rsc.li/mission-starlight** and compare with schools worldwide.

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Results

Particle size	Type of Sugar	Time (min:sec, 00:00)	Time (min:sec, 00:00)	Time (min:sec, 00:00)	Average (min:sec, 00:00)
Large grains					
Small grains					
Very small grains					
Tiny grains (powder)					

Conclusions

- Which sugar stayed in suspension for the longest time? This is what we call the 'best suspension' or 'most stable suspension'. How does this relate to particle size?
- Why do you think there was a difference in the results?
- From your results, which of these suspensions do you feel would spread most evenly on a surface and how do you think this knowledge might impact on the manufacturing of sunscreen?
- From your results what particle size would you recommend for a suspension of titanium dioxide for an astronaut?

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