

# Analytical chemistry

with Dr Ron Quinlan

## Talking points

### Knowledge

1. What are the four ingredients in beer?
2. What role does each ingredient play in the beer or the brewing process?
3. What chemical reaction occurs during fermentation?

### Comprehension

4. What is the difference between analytical chemistry and chemical analysis?
5. How does the combination of liquid chromatography and mass spectrometry help Ron's team investigate the chemical properties of beer?

### Application

6. If you were a hop farmer, how might the team's research influence your business?
7. What applications do you think analytical chemistry has in water quality monitoring, pharmaceutical production and food science?

### Analysis

8. How and why will climate change impact the beer industry? How might the team's research help to mitigate these challenges?

### Synthesis

9. Imagine you are in Ron's research team. Ron suspects that warmer growing temperatures will increase the concentration of a particular essential oil in hops, and Kevin wants to know how this would affect the flavour of his beer. How would you design an experiment to investigate this?

## Activities

### Try your own chromatography!

You can use chromatography to separate the colour components of inks and dyes. The following technique, known as paper chromatography, is less complex than liquid chromatography and can be done at home or in the classroom.

It involves placing a sample of ink or dye (the more concentrated the sample, the better the results) on a strip of absorbent paper (e.g., coffee filter paper), then placing the end of the paper strip in water. As the water soaks up through the paper, it will separate the different components of the ink or dye into individual colours.

### The colour of inks

With a pen, draw a dot of ink 2 cm from the end of a strip of absorbent paper. Place the paper in a beaker containing a 1 cm depth of water, so the ink is close to the water level but not submerged. The paper should not lean against the side of the beaker, so suspend it from a pencil placed across the top. Watch as the water separates the colours contained within the ink.

Repeat the experiment with different pens to explore the components of different inks. For example, what colours make up black, blue, red, yellow and green ink? Are all black inks made from the same colour combinations? Are there any pure inks that only contain a single colour?

### The colour of candies

You can also use paper chromatography to determine what colours are used in candies such as Skittles and M&Ms. Place a drop of water on a plate, put a candy on it and leave it for three minutes so some of the coloured coating dissolves. This drop of coloured liquid is your sample.

Repeat the ink experiment using drops of your candy coating samples instead of inks to explore the components of different dyes. For example, what colours make up red, yellow, orange, green and blue food dyes? Does a red Skittle contain the same colours as a red M&M? Does red food dye contain the same colours as red ink?

## More resources

- Visit Ron's Futurum webpage to find a PowerPoint presentation about his work: [www.futurumcareers.com/can-analytical-chemistry-make-beer-taste-better](http://www.futurumcareers.com/can-analytical-chemistry-make-beer-taste-better)
- With a few more resources, you can use paper chromatography to separate out the coloured pigments in autumn leaves. Find instructions at: [www.youtube.com/watch?v=YxOSHj\\_kVIA&t=260s](https://www.youtube.com/watch?v=YxOSHj_kVIA&t=260s)
- Learn more about the techniques and applications of analytical chemistry: [www.geeksforgoeks.org/analytical-chemistry](http://www.geeksforgoeks.org/analytical-chemistry)