UNIVERSITY OF BIRMINGHAM | SCHOOL OF CHEMICAL ENGINEERING

EngBAM

Food Safety

Teaching Resource

This resource has been designed to support the delivery of Biology and Food Science content to a GCSE class. This pack contains a presentation and a worksheet that has been developed by the University of Birmingham School of Chemical Engineering with the aim of inspiring more students to pursue a career in STEM subjects. Linking GCSE specification points to University undergraduate content, relevant industry examples and current research projects, it is hoped to further engage students with learning by highlighting how this knowledge is being applied in the industry.

Key Specification Points:
AQA GCSE Food Preparation and Nutrition:
3.4 Food safety

- Microorganisms and enzymes
  - the growth conditions for microorganisms and enzymes and the control of food spoilage
  - bacteria, yeasts and moulds are microorganisms
  - high risk foods
  - enzymes are biological catalysts usually made from protein.
- Microorganisms in food production
  - the use of microorganisms in food production.
- Bacterial contamination
  - the main sources and methods of control of different food poisoning bacteria types
- Buying and storing food
  - The food safety principles when buying and storing food.

- Preparing, cooking and serving food

  - The food safety principles when preparing, cooking and serving food.

Mentimeter

Throughout this resource there will be links to the online voting software mentimeter. This software allows for students to use their smartphones to respond to an onscreen prompt or question. The use of this tool encourages students to engage with the topic.

Slide Notes

- Slide 1 - Title

- Slide 2 - What are microbes?
  Define what a microbe is, don't give any examples at this point. Ask the students to scan the QR code using a smartphone to join a mentimeter poll (https://www.mentimeter.com/app/presentation/f3afacd864de67fbe869f142418dd23e/586c2633a613). Ask the students to list as many different types of microbes they can think of.

- Slide 3 - What are microbes?
  This slide lists different types of organisms that are classed as microbes. Compare this to the students answers.

- Slide 4 - Why should we care about microbes?
  Highlight that many microbes can people seriously ill. Link to illnesses students may be familiar with such as salmonella and norovirus.

- Slide 5 - The impact of contaminated food
  Link microbes to food poisoning. Many students may not be aware of the severity of bad cases of food poisoning, highlight that this is a condition that you can die from. Ask the students how we can ensure that our food is safe ton consume. A: Responses should be around safe storage, ensure correct cooking procedures and high levels of kitchen hygiene.

- Slides 6 to 8 - How do microbes grow?
  Introduce the acronym FAT TOM. Each letter stands for a different microbe growth condition:
  F - Food. Microbes will need nutrients to grow, rich foods are therefore at a higher risk.
  A - Acidity. Acidic foods will kill off many microbes.
  T - Time. Food should not be left out in ambient conditions for more than two hours. To prevent microbe growth food should be kept hot or cold.
  T - Temperature. Keep food out of the temperature danger zone. For safe storage food needs to be chilled or heated.
  O - Oxygen. Many microbes are aerobic, so if the food is vacuum packed then the microbes will not be able to grow.
  M - Moisture. Microbes also need to have water in order to grow. Therefore, dry foods will have a lower chance of microbes growing.

- Slide 9 - Stopping microbial growth
  Highlight to students that in order to limit microbial growth, as many of the FAT TOM factors should be limited as possible. Note that the temperature of food storage is one of the most important factors for the food being safe to eat. Further good practice to keep food safe is to adhere to foods use by dates as well as covering food when it is stored.

- Slide 10 - Microbes are everywhere
  Microbes are everywhere, therefore good hygiene practices and high levels of cleanliness are required. Good practices include good hand washing, using separate utensils for raw meat. Link this to how important high levels of cleanliness are in industry. In industry chemical engineers will need to incorporate regular machine shut down periods to allow for cleaning to ensure that equipment fouling is kept to a minimum.

- Slide 11 - Task
  This activity has an associated student worksheet on the EngBAM website. Students need to cut out each of the pictures that contain different food items. There task is to then sort the foods into two groups, low and high risk. The answer is listed below:

  High Risk:
  - Milk
  - Yoghurt
  - Eggs
  - Meat
  - Fish

  Low Risk:
  - Fruit
  - Vegetables
  - Bread
  - Sweets
  - Jam
  - Pickles
  - Honey

  Rice and pasta can be placed in either category. Ask the students why this is. When these foods are dry they have a very low risk. However, when cooking spores can be released and if stored incorrectly they can become a very high risk food.

- Slide 12 - High vs low risk foods
  Explain that certain foods and food groups are a much higher risk for microbial growth compared to others. Moist foods that are high in protein are often at a higher risk of growing pathogens.

- Slide 13 - Dangers of leftover rice
  Link back to previous discussion about the dangers of rice. Back this up with how severe the consequences of food that are not stored correctly can be. Explain the case study of the American student to show that food needs to be chilled after cooking and needs to be reheated thoroughly.

- Slide 14 - Food hygiene ratings
  A good way to ensure that the food you get when eating out is safe is by looking at food hygiene ratings. If a restaurant has a low food hygiene rating, then the chances of food being infected are higher. However, unlike other UK nations, in England companies are not required to show their hygiene rating.

- Slide 15 - Are all microbes bad?
  Ask all the students to vote whether they think that all microbes are bad.

- Slide 16 - No
  The answer to this question is that not all microbes are bad. Many microbes are very useful in the production of certain food products such as beer, cheese and bread.

- Slide 17 - Microbes for good
  Highlight to students that although a lot of microbes can make people very ill, some can be used in food production. Microbes, specifically, bacteria are often used in fermentation processes.

- Slide 18 - Microbes for good
  Three key examples of when microbes are used in food production is blue cheese, bread and yoghurt.

- Slide 19 - Growing microbes
  Chemical Engineers are involved in both the killing and growing of microbes. In many cases Chemical Engineers need to prevent microbial growth in process equipment. However, bioreactors are often also used to cultivate bacteria colonies for fermentation processes. Chemical Engineers will use the FAT TOM growth factors, to maximise microbe growth.

- Slide 20 - The fight against microbes
  Antimicrobials can be encapsulated within food packages to help to prevent any microbe growth ensuring a longer shelf life as well as an increase in food safety. As approximately one third of all food produced for human consumption is wasted, attempts to reduce food waste from both an environmental and economical stand point is very important.

- Slide 21 - Summary
  Ask the students to write down what each letter in the FAT TOM acronym means. Challenge the students to remember what the safe conditions for each of these factors are. Start a discussion on food safety to encourage the students to consolidate the information in the PowerPoint.

- Slide 22 - EngBAM
  Signpost the QR code to the EngBAM website. The student resources on the website contains personal statement tips as well as chemical engineering taster materials and lab tours.