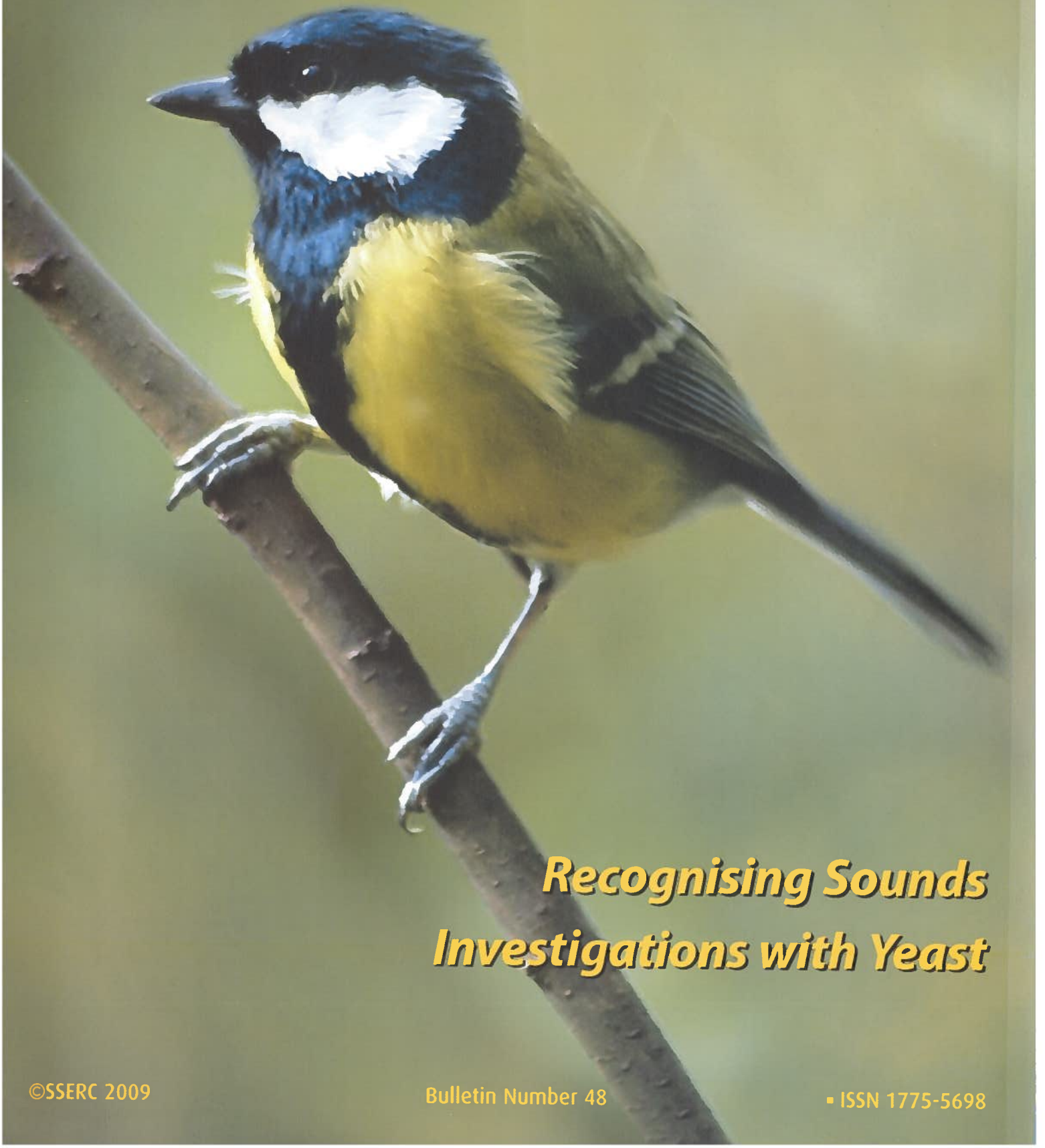
Primary Science & Technology Bulletin

Ideas and Inspiration for teachers in Primary Schools & S1/S2



Recognising Sounds
Investigations with Yeast

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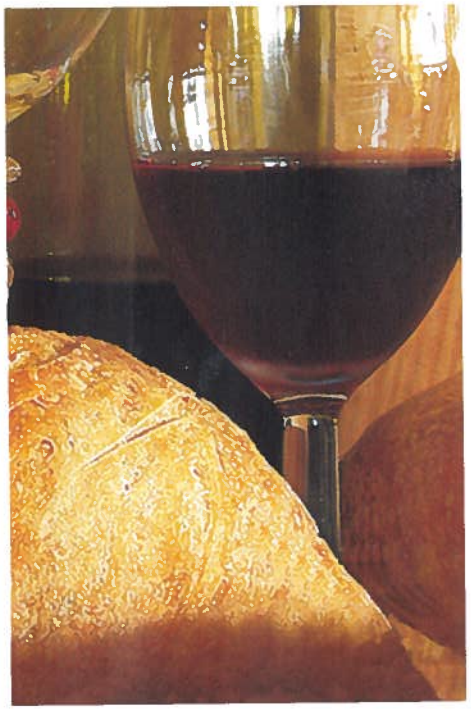
Investigations with Yeast

Yeast is a microorganism which, under the right conditions, can break down sugar and in so doing produces, amongst other things, carbon dioxide. In this article we will explore, in a variety of ways, how we can measure the production of carbon dioxide to give us an idea of what conditions are suitable/unsuitable for yeast to break down sugar.



While there are many different types of yeast, *Saccharomyces cerevisiae*, which is frequently used in the production of bread and alcoholic drinks (photo opposite), is a useful microorganism for study in the classroom. Live yeast can be obtained from bakers, or supermarkets where they make their own bread. It may be kept in the fridge in the short term or in the freezer for longer. It is worth checking that it still 'works' before using with the class if it has been kept for more than a few days.

It is best to make a paste of the live yeast with a little warm water and then add the required amount of water for the number of participating groups. We used 1-2 teaspoons of yeast in 100 ml of water. This is called a yeast suspension.

Possible investigations

Many of the experiments described here could be used to support the delivery of learning outcome **SCN 2-13a**:

I have contributed to investigations into the role of micro-organisms in producing and breaking down some materials.

How does temperature affect the action of the yeast?

Make up the yeast suspension described above then add 1 teaspoon of sugar before pouring 10 ml into each of three small bottles or test tubes (or other suitable containers). Place one in a cool place, one in a warm place and one in the fridge – note the temperature of each; it is best if all three places are dark. Observe at regular intervals. See Figure 3 for possible ways to observe this investigation, noting the amount of froth which has been produced or how the balloons inflate over time.

The yeast will tend to work best in the warm environment. Children may have done a similar experiment with plants.

These activities also have relevance to learning outcome **SCN 3-13b**:-

I have contributed to investigations into the different types of microorganisms and can explain how their growth can be controlled.

How does the amount of sugar affect the action of the yeast?

Make up the yeast suspension and pour into bottles as described above. The first should be labelled as the *control* i.e. nothing else is added. To the second add ¼ teaspoon of sugar and to the third add ½ teaspoon. Label the bottles accordingly. Different groups could make up further bottles with differing amounts of. Keep the bottles together in the same warm place and observe at regular intervals. (See Figure 3).

The action of yeast on fruit juices

Here we look at the breakdown of naturally-occurring sugars in fruits.

Obtain juice from a variety of fruits by squeezing the fruit in a (well sealed) plastic bag and then straining through a piece of muslin. See Figure 1. This is more fun and gives better results than using cartons or bottles of juice.

Figure 1 – Extracting juice from kiwi fruit and pineapple.

Put 10 ml of a prepared yeast suspension into each bottle along with 10 ml of fruit juice. Observe what happens.

Figure 2 shows the results when we used tomatoes, strawberries, oranges and blueberries. We have also tried kiwi fruit, pineapple, lemon and lime. If using harder fruits then a juicer or blender may be needed.

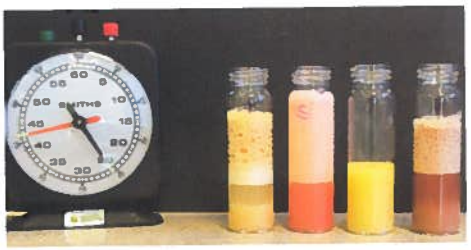


Figure 2 – Froth heights from fruit juices.

Note that there is no froth in the bottle containing the orange juice. Children could speculate as to why this is – do other citrus fruits give the same result?

The carbon dioxide which has been produced can be observed in a variety of ways:

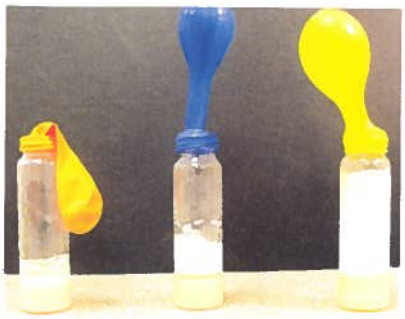


Figure 3 – Varying the amount of sugar.

Figure 4 – Plastic fermentation lock (airlock) which can be obtained from local home brewing suppliers or on-line supplier [1].

Figure 5 – Dough made as described with 0 g, 2 g, 10 g and 20 g of sugar added.

Using balloons

Securing balloons over the neck of the tubes will trap the CO_2 and so the balloon will fill up. Balloons should be well stretched before use but even then they may not fully inflate so it may difficult to compare the effects of the variable being investigated in a quantifiable way. Using balloons does, however, provide a very nice, visual way to demonstrate carbon dioxide evolution.

Measuring froth

Note the froth in the bottles in Figures 2 and 3. By measuring the height of the froth which forms it can also provide a measure of the amount of carbon dioxide which has been produced. The height of the froth could be measured at regular intervals and the results graphed.

Figure 3 shows the results of an investigation into varying the amount of sugar added. The bottles contain the following amounts of sugar: orange balloon – none, blue ¼ teaspoon and yellow ½ teaspoon.

Counting Bubbles

Another way to "observe" the evolution of carbon dioxide is by using a fermentation lock. This allows you to count the bubbles of gas going through the lock and can allow pupils to look at the rate of release of the gas over a period of time. Again results could be used to produce bar charts or line graphs.

Making Dough

Here we use the ability of yeast and sugars (naturally occurring or added) to make a froth. Dough is quite gooey so the 'froth' is quite limited and won't fill your oven! Make up a yeast suspension as previously described. Put 30 g flour into each of several plastic cups and add varying amounts of sugar (Figure 4). Mix well. Add the same amount of the yeast suspension to each cup and then add warm water until an appropriate consistency is obtained when the contents of the cup are mixed. Ensure that the mixture is pressed into the bottom of each cup so that the starting points are roughly equal. Leave in a warm place in the classroom and observe. This could be "run" as a Dough Race with a winner *selected after 15 minutes. Is the result still the same after 30 or 60 minutes?*

Further possible investigations and questions

What if we used 2 g, 4 g, 6 g, 8 g and 10 g of sugar?

Why does the one with no sugar rise? (There is enough glucose in the yeast cells to activate them and then they are able to break down the starch).

Why is there very little difference between the first three? (Figure 5).

Why don't the last two rise? (The high concentration of sugar will cause the yeast cells to lose water (osmosis) and so they will be unable to function).

There are lots of videos about yeast on YouTube e.g. What does yeast like to eat? [2]

Links to CfE

The Science 3-18 website [www.science3-18.org] contains a range of activities which support the teaching of the learning outcomes in this article. In particular it would be worth exploring the link given [3].

References

[1] http://www.home-brew-online.com/?gclid=CP6xu_f56JsCFaAA4wodKiOS5Q
[2] http://www.youtube.com/watch?v=4mxqGF9JZHI&feature=related
[3[http://www.science3-4. 18.org/index.php?option=com_content&view=category&id=404: scn-1-13a-germs-and-spreading-disease&layout=blog&Itemid=635&layout=default

Recognising Sounds

Topical Science [1]

I have contributed to discussions of current scientific news items to help develop my awareness of science. **SCN 1-20a**

I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. **SCN 2-20b**

Forces, Electricity and Waves [2]

By collaborating in experiments on different ways of producing sound from vibrations, I can demonstrate how to change the pitch of sound. **SCN 1-11a**

Through research on how animals communicate, I can explain how sound vibrations are carried though air, water and other media. **SCN 2-11a**

In a BBC News story [3] it was reported that scientists from Aberystwyth University have discovered that great tits which live in cities sing more loudly, and at a higher pitch, than their country cousins. Furthermore the city birds do not recognise the song of the country birds and vice versa.

Using Audacity (see Primary Bulletins 37 [4] and 47 [5] for details of how to download and use this free software) we recorded the birdsong from the links on the BBC News site and obtained the "sound fingerprint" of the bird's song (Figure 1). If hearing a difference is not easy then seeing the difference certainly is – top trace is the urban bird and the bottom one is the rural bird:

The connection between sound and waves can also be "seen" by using the "Zoom In" tool in the View menu. The result is shown in Figure 2.

Further information about the Great Tit can be found on the BBC Science & Nature website [6] which provides information about a large number of birds (and other animals) and could be used to provide recordings of the calls of some common British birds.

Related Activities

Children could investigate whether they would have the same difficulties as the Great Tit with recognition of voice if the pitch is changed. This is difficult to achieve if the children try physically to raise or lower the pitch of their voices but using Audacity it is very straightforward and effective.

Have the children record a statement and then alter the way it sounds using *Effect* and selecting *Change Pitch* from the drop-down menu. There is a choice of how to achieve this – either by selecting a percentage by which to raise or lower the pitch or selecting the note that you want to raise / lower to.

As can be seen from this screen shot the notes which make up the sound are listed – gives a link which may be useful in helping to address Experiences and Outcomes in Expressive Arts.

A fun "don't try this at home" example of changing voice pitch can be found on Youtube [7].

Cover image courtesy John Hammell.

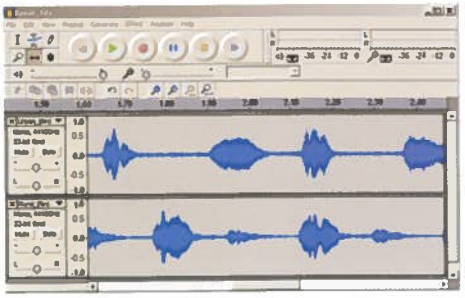


Figure 1 – Screenshot from Audacity showing bridsong fingerprints'.

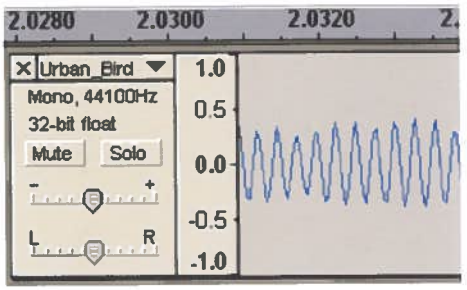


Figure 2 – Zoomed-in view of birdsong from the urban bird.

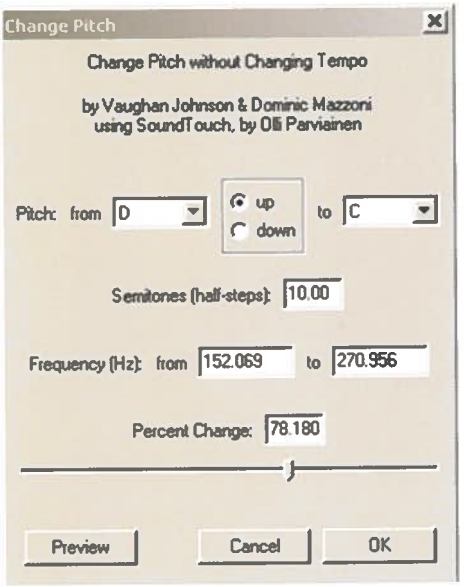


Figure 3 – Adjusting the pitch using Audacity.

References

[1] http://www.science3-18.org/index.php?option=com_content&view=section&id=102&Itemid=583

[2] http://www.science3-18.org/index.php?option=com_content&view=section&id=98&Itemid=590

[3] http://news.bbc.co.uk/1/hi/wales/mid/8079539.stm

[4] http://www.ise5-14.org.uk/prim3/New_Guidelines/Newsletters/37/Audacity.htm

[5] Primary Science & Technology Bulletin No. 47, Variation in the Classroom (Voice patterns). Online version coming soon.

[6] http://www.bbc.co.uk/nature/wildfacts/factfiles/249.shtml

[7] http://www.youtube.com/watch?v=d-XbjFn3aqE&NR=1