Answers

1. The capsaicinoid molecules are relatively non-polar. They have an aromatic ring and a long hydrocarbon chain along with some polar groups. Thus they are likely to be relatively insoluble in water and not readily washed from the mouth by a drink of water. Milk might be a more effective drink as the relatively non-polar capsaicinoid molecules would be expected to dissolve in the fat globules contained in milk.

2. A standard mass of chilli must be used. The amount of solvent in which the chilli is dissolved must be kept the same. Pressure, temperature, flow rate and the length and diameter of the column can all affect retention times as well and must be kept constant.

3. The HPLC test should be more reliable as the Scoville test depends on human tasters who may differ from day to day and from one another.

4. Chilli (a) would be hotter because the peak heights for both capcsacin and homocapsaicin are higher in chromatogram (a) than in (b).

5. (a) The double bond in capsaicin has been hydrogenated in dihydrocapsaicin.

   (b) Aromatic ring, phenol, ether, amide and alkene.

   (c) *Cis-trans* isomerism. This is a result of the fact that there is no free rotation about a carbon-carbon double bond.

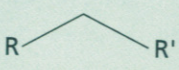
   (d) A reducing agent such as hydrogen with a nickel catalyst will reduce C=C but not C=O. Note that reagents such as sodium tetrahydridoborate(III) and lithium tetrahydridoaluminate(III) are unsuitable as they would reduce the C=O group.

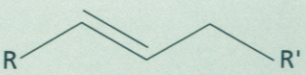
6. The solid phase is the paper (strictly water bonded to the paper) and the liquid phase is water (or other solvent such as ethanol or propanone).

7. Chefs and food processing companies will need to know how hot chillies are in order to know how much to add to their recipes. Chefs may well do this by personal tasting but food processing companies may well prefer a more objective measurement.

8. The representations are:

dihydrocapsaicin 

nordihydrocapsaicin 

homocapsaicin 

homodihydrocapsaicin 

They show that capsaicin and dihydrocapsaicin differ only in that the former has a carbon-carbon double bond while the latter does not.

Nordihydrocapsaicin lacks the double bond and has a carbon chain one carbon atom shorter than that in capsaicin. Homocapsaicin and homodihydrocapsaicin both have a carbon chain one carbon atom longer than capsaicin. Homocapsaicin has a carbon=carbon double bond and Homodihydrocapsaicin does not.