

# MICROSCOPICAL EXPLORATION

## THIRTY FIVE

### ACIDS IN THE DARK

Many people might assume that they have never come across any of the following chemicals, as named by the International Union of Pure and Applied Chemistry (IUPAC):

- i) (5R)-[(1S)-1,2-Dihydroxyethyl]-3,4-dihydroxyfuran-2(5H)-one,
- ii) 2-hydroxypropane-1,2,3-tricarboxylic acid,
- iii) 2-hydroxybutanedioic acid,
- iv) 2,3-Dihydroxybutanedioic acid

However, readers of Micscape Magazine might recognise them as the subjects of previous Microscopical Explorations, and most people will have consumed them as part of their normal healthy diet. The chemicals are more widely known by their common names:

- i) Ascorbic acid or vitamin C
- ii) Citric acid or sour salt
- iii) Malic acid or apple acid
- iv) Tartaric acid or winestone

Grouped together these four organic acids are sometimes referred to as 'fruit acids' due to their occurrence in significant quantities in fruit and vegetables, and in their pure form all are readily available as white crystalline solids sold as food supplements.

The pure crystals are shown in the pictures below, which were captured using a Brunel MX7 stereo microscope fitted with a Brunel Eyecam Plus eyepiece camera at 1600x 1200 pixels and using a black stage-plate and incident illumination.

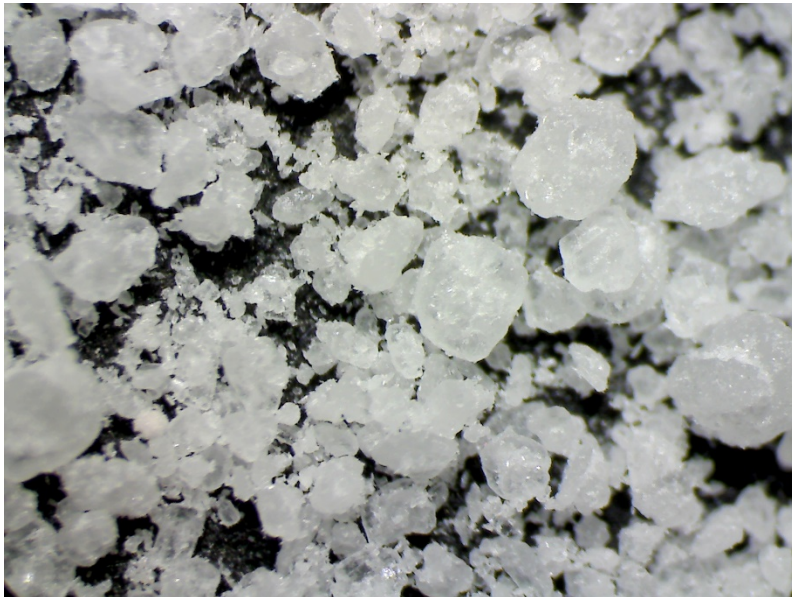
**Ascorbic acid**



**Citric acid**



**Malic acid**



**Tartaric acid**



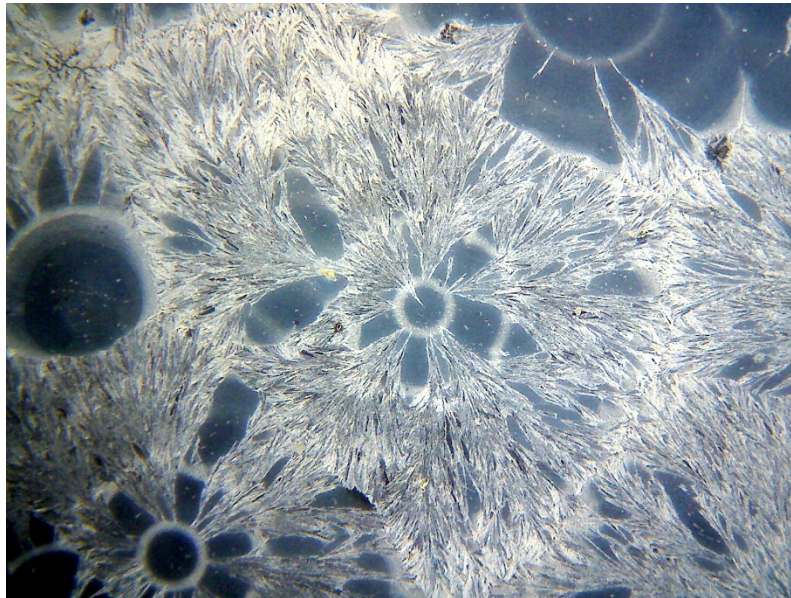
All the fruit acid crystals shown above conform with the Monoclinic crystal system and, particularly in the case of tartaric acid, show significant polymorphism.

A separate solution of each of the acids was made by dissolving 0.5 grams of the crystals in 10mls of a 50/50mixture of water and 90% Industrial Methylated Spirit.

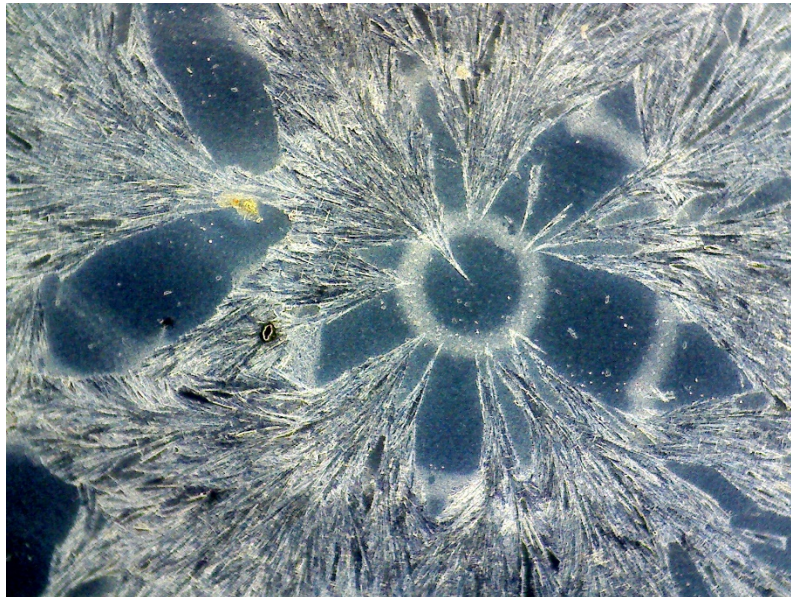
Specimen slides were prepared by pipetting 150 $\mu$ L of the acid solution onto a clean microscope slide and allowing it to evaporate on a warm electric hotplate at around 50°C.

As is suggested in the sub-title above, the slides were observed using dark field illumination. In order to do this, my Apex Practitioner microscope was fitted with short barrel x4, x10 and x20 objectives, each with a focal length of 36.65mm, and dark field stops of 11mm, 13mm and 15mm diameter, placed in the sub-stage filter holder, were used for the observations at each magnification respectively. All the following images were captured using a Brunel Eyecam Plus eyepiece camera at 1600x1200 pixels resolution and Swift Imaging 3.0 image capture software.

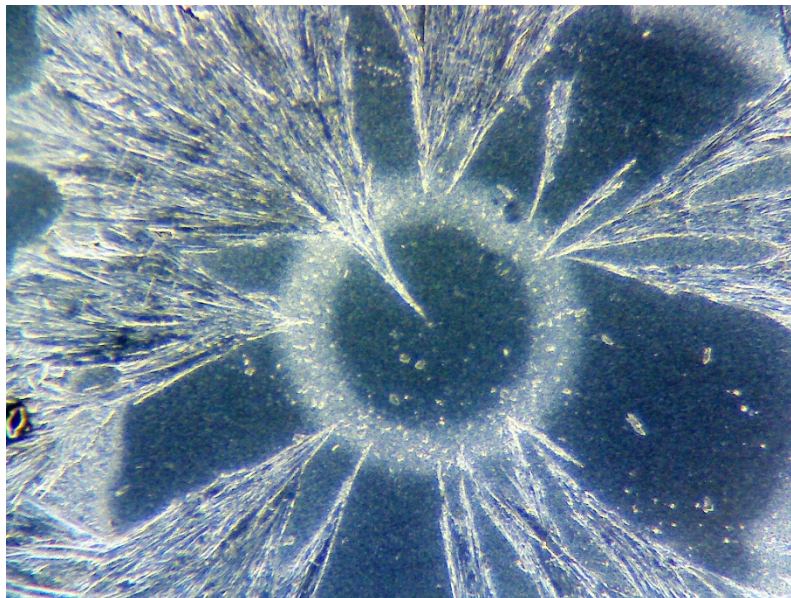
**Ascorbic acid x4**



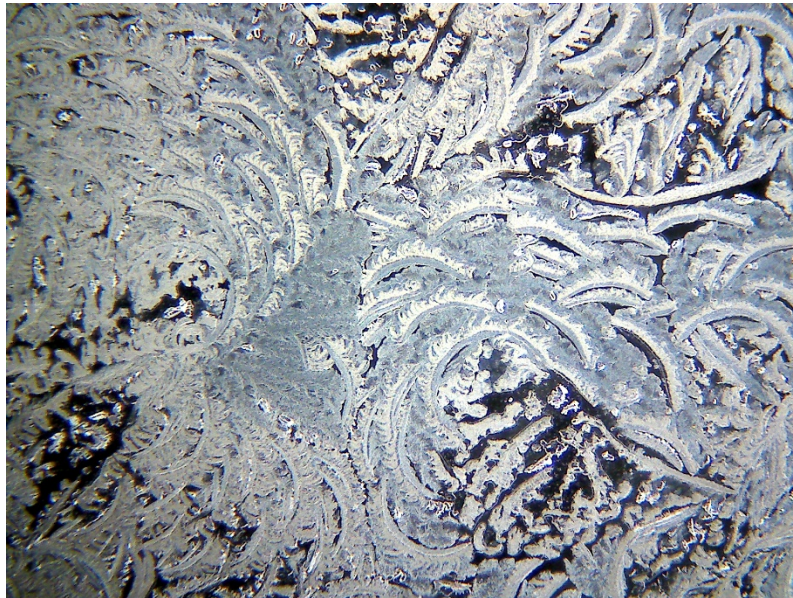
**Ascorbic acid x10**



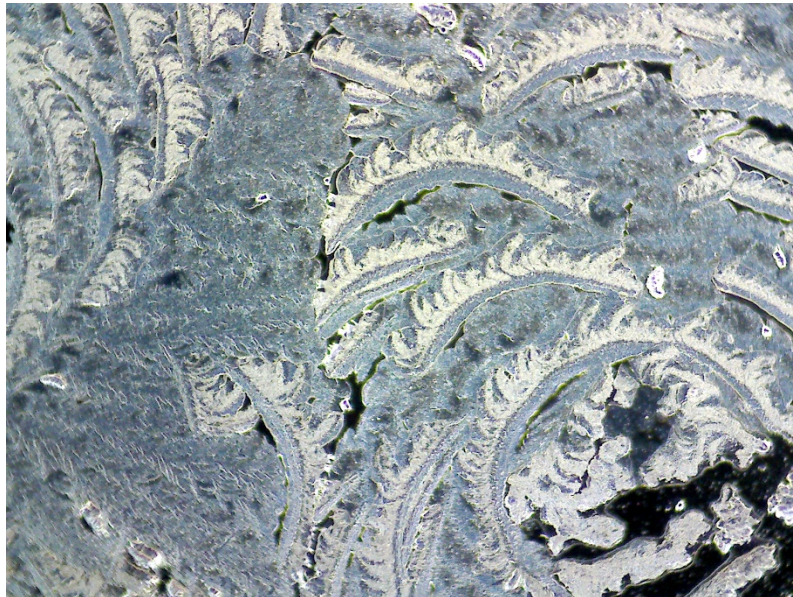
**Ascorbic acid x20**



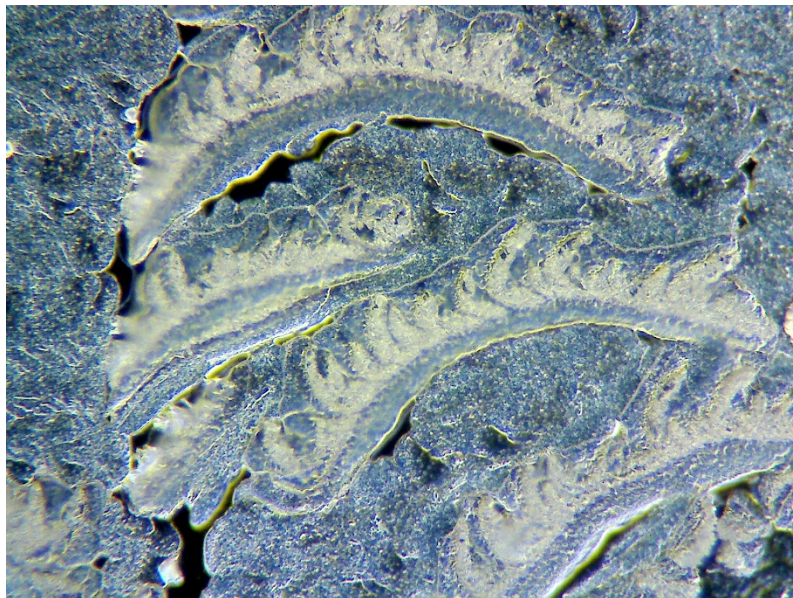
**Citric acid x4**



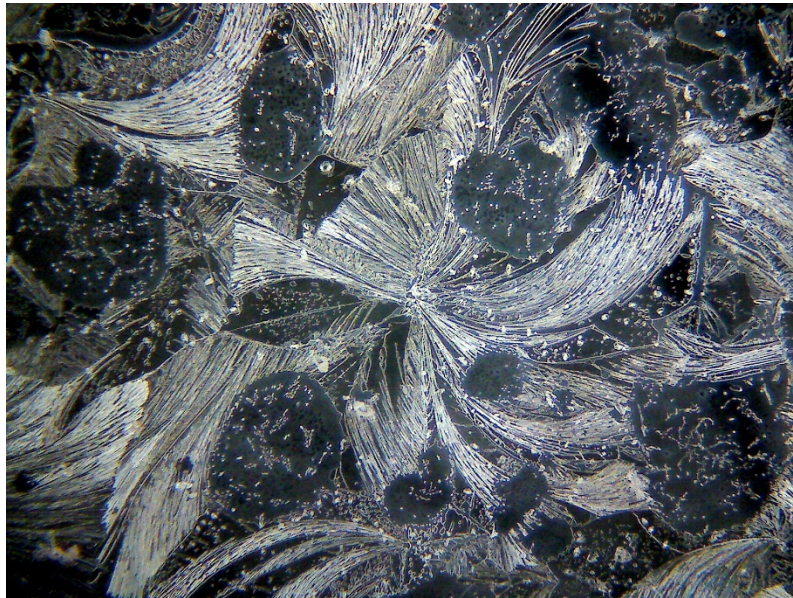
**Citric acid x10**



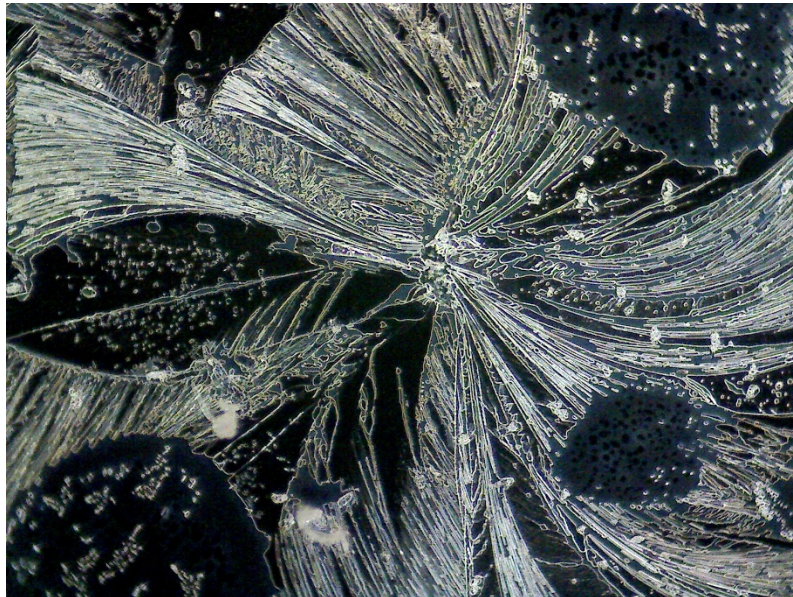
**Citric acid x20**



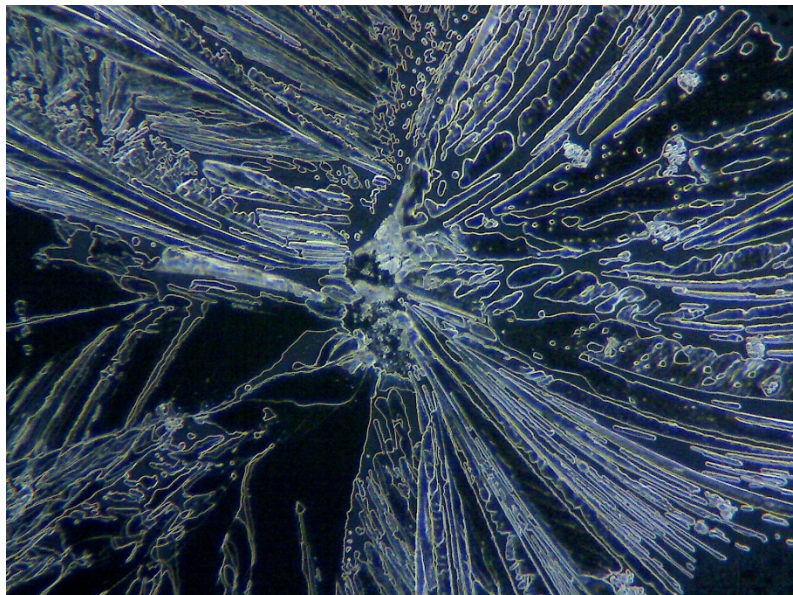
**Malic acid x4**



**Malic acid x10**



**Malic acid x20**



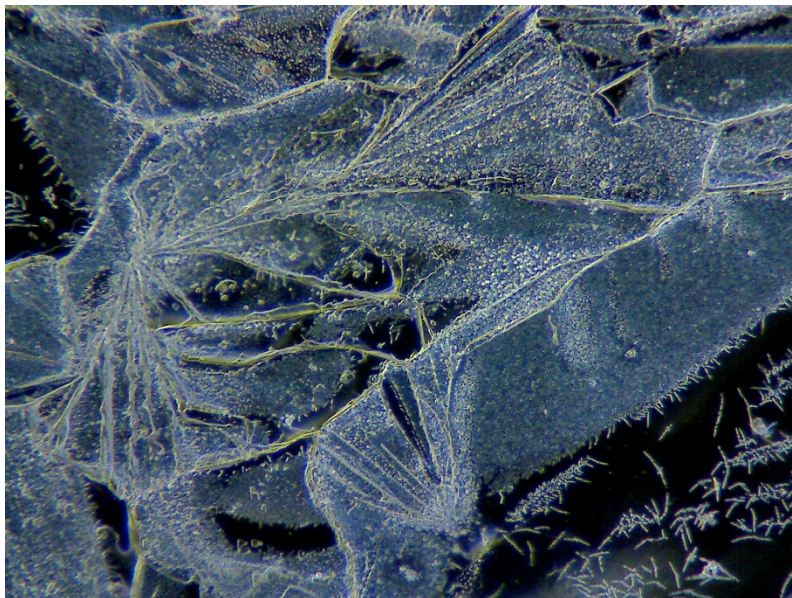
**Tartaric acid x4**



**Tartaric acid x10**



**Tartaric acid x20**



As I type this conclusion I can assure you, my esteemed reader, that I have enjoyed my daily ration of the first three of the subjects of this Microscopical Exploration, and that it is not beyond the bounds of possibility that I will enjoy a glass of a dark coloured liquid containing the fourth before the day is out.

**James Stewart**  
**Cumbria**  
**UK**

**As we say here in Cumbria:**

**‘Ave a go yersel’!**

**Comments, gratefully received, to:**

**stewartr178ATyahooDOTcoDOTuk**

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