

All data taken at Pacific Northwest National Laboratory (PNNL)

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**SAMPLE CONDITIONS & PHYSICAL PROPERTIES**

|                          |  |                     |
|--------------------------|--|---------------------|
| Chemical name            | Diphenic acid                                  |                     |
| Chemical formula         | C <sub>14</sub> H <sub>10</sub> O <sub>4</sub> |                     |
| Synonyms                 | Biphenyl-2,2'-dicarboxylic-acid                |                     |
| CAS number               | 482-05-3                                       |                     |
| Location of field sample | n/a  |                     |
| History of sample        | n/a  |                     |
| Molecular Weight         | 242.23 g/mole                                  |                     |
| Melting Point            | 227-229 °C                                     |                     |
| Boiling Point            | n/a  |                     |
| Density (25 °C)          | 1.29 g/cm <sup>3</sup>                         |                     |
| Hardness, Mohs scale     | n/a  |                     |
| Crystallography:         |  |                     |
| Cell dimension           | a = Å b = Å c = Å                              |                     |
| Crystal system           |  |                     |
| H-M symbol (point gr)    |  |                     |
| Space group              |  |                     |
| H-M symbol (space gr)    |  |                     |
| Crystal habit            |  |                     |
| Color                    | Yellow-brown                                   |                     |
| Diaphaneity              | Sub-translucent to opaque                      |                     |
| Particle size            | 26 ± 17 µm                                     |                     |
| Particle size assessment | Optical microscopy                             |                     |
| Supplier                 | Aldrich  |                     |
| Stated purity            | 97%  |                     |
| Date packed              | 1 September 2016                               | Weight: 1.026 grams |
| Synthesis method         | n/a  |                     |
| Synthesis reference      | n/a  |                     |
| Texture                  | Fine, fluffy powder                            |                     |
| Physical state           | Solid  |                     |
| Surface roughness        | n/a  |                     |
| Elemental composition    | n/a  |                     |
| Isotopic composition     | n/a  |                     |
| Moisture content         | n/a  |                     |
| Temperature of sample    | 25 ± 2 °C                                      |                     |
| Substrate                | n/a  |                     |

## INSTRUMENT PARAMETERS

### Tensor 37 FT-IR manufactured by Bruker Optics

|  |  |
|--|--|
| External diffuse reflectance accessory | A 562-G integrating sphere   |
| Sphere diameter                        | 75 mm  |
| Angle to normal incidence              | 14.8°  |
| Sphere opening diameter                | 19 mm (entrance port)  |
| Spectral range                         | 7,500 to 600 cm <sup>-1</sup> saved; 7500 to 600 cm <sup>-1</sup> reported |
| Beamsplitter                           | Ge on KBr  |
| Detector (dia. Det. Port in sphere)    | 2×2 mm, 60° field of view MCT (550; 0.9); 1 cm                             |
| Apodization function                   | Blackman-Harris 3-term   |
| Aperture                               | 6 mm   |
| Coadded scans                          | 2048   |
| Scanner speed                          | 40 kHz   |
| Switch gain on                         | 512 points   |
| Low pass filter                        | Open   |
| Scan technique                         | double-sided, forward-backward   |
| Non-linear correction                  | On   |
| High and low folding limit             | 15800.54-0.00 cm <sup>-1</sup>   |
| Phase resolution                       | 32.00  |
| Phase correction mode                  | Mertz  |
| Zerofilling                            | 4×   |
| Wavenumber accuracy                    | ± 0.4 cm <sup>-1</sup>   |
| Spectral resolution                    | 4 cm <sup>-1</sup>   |
| Accuracy verification                  | 10/28/2015   |
| Wavelength vetted on:                  | ICL polystyrene standard #0009-7394-0025A, thin film                       |
| Reflectance:                           | ±2% using SRS reflectance standards 50-010-DH27B-4878                      |

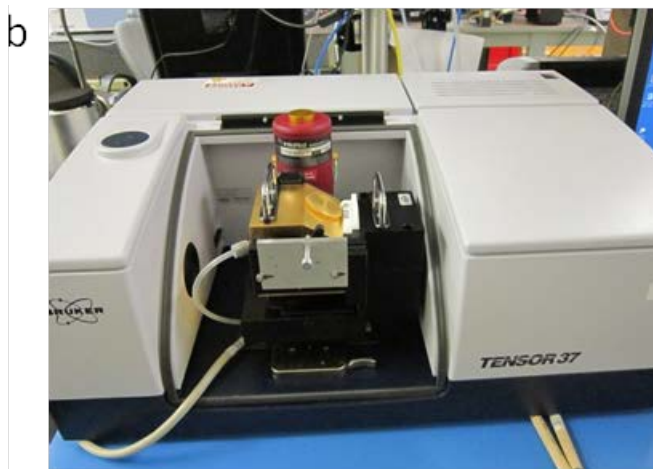
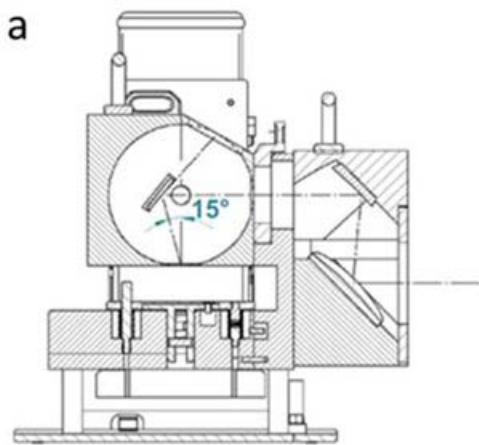


Figure 1: The Bruker 562-G integrating sphere (a) and Tensor 37 (b)



## PARTICLE SIZE PREPARATION AND CHARACTERIZATION

### Optical microscopy —

A Keyence VHX-1000 digital microscope with 16-bit resolution is used to provide photomicrographs of the various samples and particle sizes. Software included with the microscope differentiates the brightness and colors in the image and extracts the bright objects to produce a binary image. The software assumes all adjacent bright points are part of the same object then calculates the area for each of these objects. The area (A) is used to calculate the mean particle diameter (d) by assuming the particles are spherical and using the relationship  $d = \sqrt{4A/\pi}$ . Although the assumption of spherical particles is clearly not always valid, this procedure provides a reasonable estimate of the mean particle size.

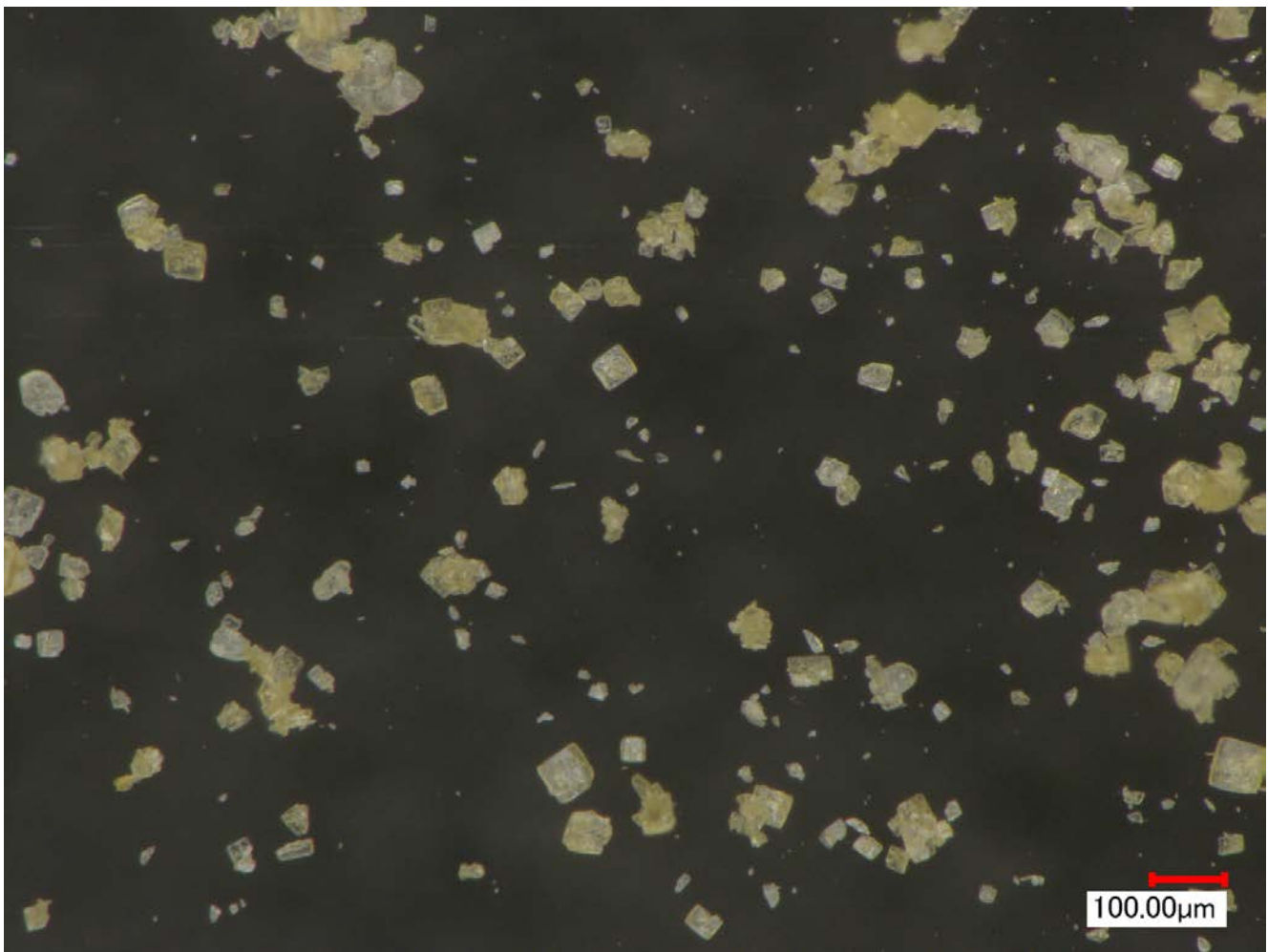


Figure 4: Photomicrograph of Diphenic acid.

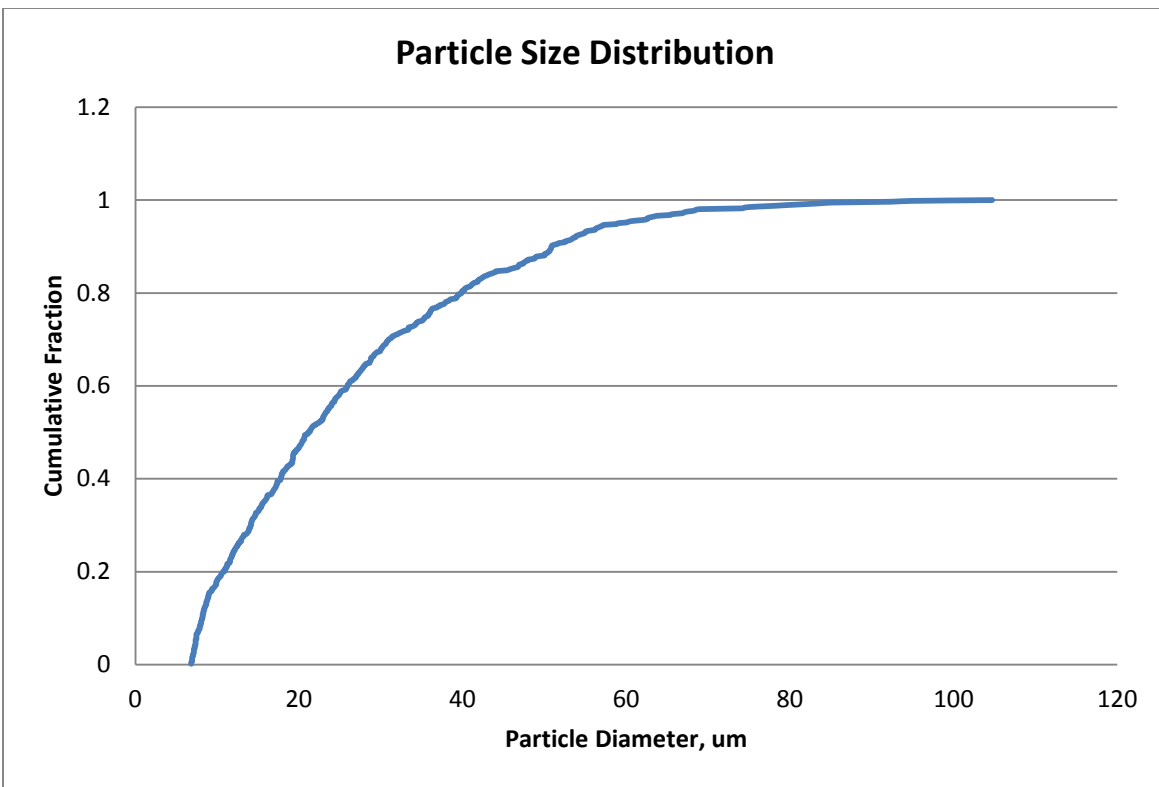


Figure 5: Particle size distribution of Diphenic acid.