# The investigation of shoreline waxy deposits on UK coastlines

Jan Brant
Cefas
Jan.brant@cefas.co.uk

Heather Emerson
Cefas
heather.emerson@cefas.co.uk

Cherry Jones
Cefas
cherry.jones@cefas.co.uk

Kieran Hyder
Cefas
Kieran.hyder@cefas.co.uk

Callum Scougal
Cefas
callum.scougal@cefas.co.uk

Mark Kirby
Cefas
mark.kirby@cefas.co.uk

**Introduction**

There are sporadic incidents of waxy deposits washing up on beaches, particularly after storm events. The frequency and location of these events is not well known as generally only the very large events are reported to local councils and the MCA. The identity of these products is not well characterised, and while most deposits are attributed to palm oil, few chemical analyses exist to support this assertion. In order to understand the magnitude of the issue, Cefas undertook a study to gather information on the frequency of occurrence, distribution, and nature of the substance(s) being washed up.

The project aimed to establish a process by which these deposits could be recorded, archived and processed to give an indication of the type of substance present, as well as exploring existing reporting mechanisms. The positive identification of the substances also ensured that any advice given to the public or councils on how to deal with incidents would be in full knowledge of the substance being dealt with.

A short review was undertaken of existing studies, citizen science projects, and any previous analyses done by the local councils. We engaged with existing coastal citizen science campaigns to gather data and samples of deposits for chemical analysis.

Simple analytical techniques were employed to characterise substances and a database was created which also acted as an identification tool, holding simple physical and chemical characteristics (such as colour, size, melting point, density and solubility) in order to compare substances, and enable identification.

**Results**

A simple script was written to compare the properties of samples of unknown waxy beach deposits to a database of known substances to help identify their likely composition. The program stores information such as the spatial and temporal distribution of the waxy deposit samples, and their resemblance to known substances in a simple spreadsheet, which acts as a sample database.

The approach adopted for identification of an unknown substance was based on a rating that reflected its resemblance to the each of the known substances. The accuracy of this program will therefore improve over time as further data become available about known substances.

Information on the size, location and other descriptive factors of the sample were combined in a database with the properties of that sample, as well as properties of reference waxy substances, derived from the literature or Cefas analysis. The database was then read by the script code, and the beach deposit's properties were compared to each of the reference substances. If the value fell in the range associated with the reference substance, it scored 1. Scores were given for each parameter, and the total score for each reference substance was calculated and averaged. The substance with the highest overall score (based on the average) was said to have the best resemblance to the beach deposit.

**Table 1: Results of Database analysis of Shoreline Deposits**

| Sample ID/LSN | Unknown1 | Unknown2 | Unknown3 | Unknown4 | Unknown5 | Unknown6 | Unknown 7* |
|---|---|---|---|---|---|---|---|
| Location description | Bawdsey, Suffolk | Bawdsey, Suffolk | Bawdsey, Suffolk | Bawdsey, Suffolk | Bawdsey, Suffolk | West Angle Beach, South Pembrokeshire | St Helena, South Atlantic |
| density | 0.726 | 0.769 | 0.847 | 0.917 | 0.918 | 0.936 | 1.38 |
| Acid Value | 0 | 0 | 0.6 | 0 | 1.3 | 0.099 | 0 |
| Saponification value | 0.68 | 1.3 | 0 | 2.8 | 1.3 | 214.6 | 0 |
| Melting point | 58 | 57 | 57 | 65 | 64 | 35 | 78 |
| UV fluorescence | 15455 | 14743 | 15455 | 418 | 485 | 125 | 14722 |
| UV absorption | 2.022 | 1.997 | 0.05 | 0.144 | 1.964 | 0.029 | 3.461 |
| UVF 1° peak (nm) | 316 | 315 | 314 | 314 | 315 | 314 | 308 |
| UVF 2° peak (nm) | 328 | 329 | - | - | 328 | 328 | 357 |
| UVF 3° peak (nm) | - | - | - | - | - | - | 327 |
| Most resembles | Petroleum paraffin laboratory | Petroleum paraffin laboratory | Petroleum paraffin laboratory | Petroleum microcrystalline (E905) amber literature | Petroleum paraffin laboratory | Petroleum paraffin laboratory | Petroleum microcrystalline (E905) amber literature |
| Next Resembles | Carnauba (E 903) laboratory | Carnauba (E 903) laboratory | Carnauba (E 903) laboratory | Petroleum paraffin laboratory | Beeswax Crude | Peat literature | Petroleum microcrystalline (E905) white literature |

* Historic sample previously identified as a tar ball

Results of the analysis and database identification of unknown substances is shown in Table 1. All of the products were designated as petroleum based (either paraffin or microcrystalline). The GC-MS data for unknowns confirms this. The St Helena sample had previously been identified as being a tar ball. The limited sample size (given that 5 of our 6 unknown samples were from the same location and 4 of those collected in the same period) means that it is difficult to interpret if the database would have assigned a different identity had the samples all been very different. The number of known substances tested was also fairly limited, and literature data were not available for all of our database parameters for other substances. We are, however, confident that the identification process for these samples has been successful.

## Conclusion

We have tested a number of known substances using a range of parameters, and populated a database with these data, along with some literature values. Unknown shoreline deposit samples have been tested against this database, which has successfully predicted the most likely substances for the samples tested.

Limited data on knowns and unknowns has made positive identification challenging. As the amount of data in the database builds there will be more certainty in the resemblance information derived. If no clear identification can be made, where there may be influences by unknown variables such as age of sample, weathering effects, mixtures with other components we can cross reference with GC-MS data.

From our enquiries so far, local authorities have indicated that they would welcome advice and guidance on response to the incidents of waxy deposits. Existing procedures appear to be different for each organisation. Rapid identification of a substance means that the substance can be disposed of appropriately and in the most cost-effective manner. During the course of this project, the MCA have written a STOp note that will advise local authorities on appropriate action (MCA, 2018). Cefas were able to feed into this process as a result of communication during this project.

We recommend that advice to local authorities includes the delivery of samples to Cefas for both identification purposes, but also for addition of samples to the database, to build an overall UK picture of events occurring. Further work is also required on the analysis of known substances, to complete datasets where literature values are missing. This will allow further refinement of the database resemblance tool.

If we are gathering data from citizens we must be sure it can be useful to us, for example having good descriptions of the size and colour of the deposit and being able to link it to the correct location. There is not sufficient data at this stage to understand if the size and/or colour of a deposit can be an indicator of substance type, but gathering more data may make it possible to identify the substance based on the size range it is found in (for example).

## References

Maritime and Coastguard Agency. 2018. Mineral and Vegetable Oil Pollution – Guidance For Shoreline Response. Scientific, Technical and Operational Advice Note - STOp 1/18
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/672074/STOp1-18.pdf