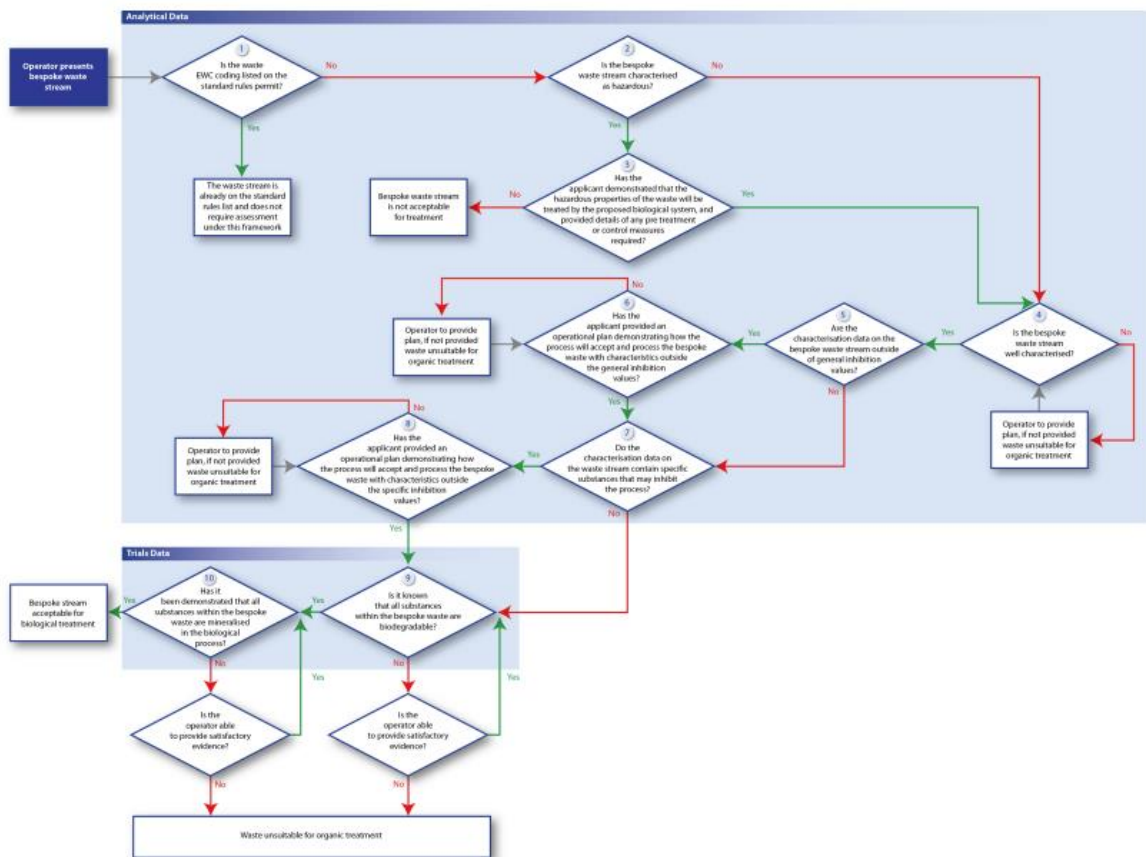


Jacob's Assessment of Non-Hazardous Glycols & Anti-Freezes

Classified as 16 01 15

The Jacob's assessment is a Technical Guidance report working with the Environment Agency (and the implementation of WM3) to determine the suitability of waste streams for Anaerobic Digestion and provides a Decision Framework to be applied to individual waste streams.



Question 1: Is the waste EWC coding listed on the standard rules permit?

Answer: No. The EWC coding is 16 01 15.

Question 2: Is the bespoke waste stream characterised as hazardous?

Answer: No, waste is non-hazardous. The waste has been classified under WM3 and found to be non-hazardous.



Question 3: Has the applicant demonstrated the hazardous properties of the waste will be treated by the proposed biological system, and provided details of any pre-treatment or control measures required?

Answer: Waste not classified as hazardous. Some anti-freezes contain mono ethylene glycol & propylene glycol which are hazardous by H410 (>25%), H302 (>25%) and H319 (>20%). If either of these chemicals are present in quantities at 20% or over, the waste would be classified under 16 01 14 instead of the 16 01 15 EWC code and would be classed as hazardous. Waste4Generation will only be accepting anti-freezes which are correctly classified as 16 01 15.

Question 4: Is the bespoke waste stream well characterised?

Answer: Yes, the waste is well characterised, with various sources of the waste streams being repeatedly sampled & tested. Both mono propylene glycol and mono ethylene glycols have been tested as both are readily used within anti-freezes. Various sources include airport runways, cooling systems, local garage forecourts, car showrooms as well as anti-freeze producers. Anti-freezes which have been used at airports, or to de-ice cars etc tend to be very dilute, as they are washed off, and often contain a great deal of snow melt. Much of testing has been undertaken over winter where the use of anti-freeze is much more prevalent.

Question 5: Are the characterisation data on the bespoke waste stream outside of general inhibitions levels?

Answer: Glycols which form a part of most anti-freezes are a form of alcohol. The threshold levels listed on the Jacob's assessment lists a general threshold of 43g/L for Alcohols, with short chained alcohols being less toxic than long chained alcohols. Both mono ethylene glycol based anti-freeze and propylene glycol based anti-freezes were analysed up to a concentration of 20% and no inhibitory effects were detected. The digestibility studies were repeated a number of times, and there was found to be no accumulation of inhibitory effects, if anything Waste4Generation found the biomass to begin acclimatising to the waste stream. Concentrations of alcohol at 20% or over within anti-freeze (specifically ethylene glycol and propylene glycol) are considered hazardous, and are not classified under 16 01 15, but are classified under 16 01 14. Therefore, any anti-freezes Waste4Generation accept would have non-inhibitory and non-hazardous concentrations of alcohol present. Waste4Generation has strict pre-acceptance and acceptance parameters to protect the plant and process.

As Question 5 demonstrates Waste4Generation will only be accepting waste streams below potential inhibitory limits, the assessment moves directly onto Question 7.

Question 7: Do the characterisation data on the waste stream contain specific substances that may inhibit the process?

Answer: Yes, however extended digestibility studies have observed no inhibition, nor any accumulation or deterioration over time.



Question 8: How has the applicant provided an operational plan demonstrating how the process will accept and process the bespoke waste with characteristics outside the specific inhibition values?

Our high-rate AD works differently than that of typical anaerobic digestion, and Waste4Generation are also have the capability to feed the reactors in series. By feeding in series, this allows potential inhibitory constituents to be hydrolysed within on reactor, and converted to biogas with the second reactor, preventing the sensitive methanogenic bacteria from coming into contact with any potentially inhibitory constituents. Waste4Generation have trialled the waste outside of specific inhibition values and no inhibition of either biodegradability nor conversion to biogas was observed. Waste4Generation also consistently observed biogas quality in excess of 80%, therefore no inhibitory affect was observed on biogas quality either.

Question 9: Is it known that all substances within the bespoke waste are biodegradable?

Answer: Yes, the waste stream was found to be fully mineralised as part of our digestibility studies.

Question 10: Has it been demonstrated that all substances within the bespoke waste are mineralised in the biological process?

Answer: As above, the trials found that the waste could be fully mineralised, even at high COD loading of the biomass.