

Environmentally benign chemical processes, questions for oral exams 2017

1. Basic unit operation: sedimentation, filtration, flotation, centrifugation, extraction, distillation, adsorption, absorption, crystallisation. Basic principles, typical equipment (min one industrial example each).
2. Green chemistry, green engineering and sustainable development. Danger and risk. The simplest quantification equations of environmental impact: E factor, EQ factor. Calculation, evaluation, advantages, disadvantages.
3. Terms to compare reactions from the point of view of their environmental impact: atom selectivity, atom efficiency, conversion. Terms to compare technologies: intensity factors. The basic concept of life cycle analysis. Solvent recovery, waste management.
4. Integrated Pollution Prevention and Control directive. Best available technology principle. Explain the concept on the example of reducing N_2O and NO_x emission of the nitric acid production.
5. Purification of industrial waste waters. Classification of available methods based on the properties of the contaminants.
6. Wet air oxidation. Supercritical water oxidation. Comparison.
7. Sublimation. Batch and continuous processes.
8. Lyophilisation.
9. Short pass distillation. Molecular distillation.
10. Importance of residence time distribution during atmospheric and vacuum distillation /evaporation processes. Comparison of different techniques.
11. Membrane processes. Balance equations, typical membrane modules. Batch, semicontinuous and continuous processes.
12. Classification of membrane processes based on driving force.
13. Microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), reverse osmosis (RO)

14. Pressure swing distillation (minimal or maximal boiling point azeotropes).
15. Supercritical fluids, properties, solubility in supercritical solvents. Applications of supercritical carbon dioxide for extraction (extraction of plant product, decaffination of tea or coffee).
16. Supercritical fluids, properties, solubility in supercritical solvents. Applications of supercritical carbon dioxide micronisation (basic principles of RESS, GAS, PGSS techniques)
17. Classification of plant constituent by their chemical structures. Typical processes for their separation.
18. Steam distillation.
19. Preparing edible oils: pretreatment, pressing.
20. General considerations regarding biodiesel, biogas and bioethanol.
21. Bioethanol: raw material, fermentation, byproducts.
22. Biodiesel: raw material, transesterification
23. Biogas: raw material, fermentation.