Waughter

AKTION CONSULTANCY

Volume 3 : Edition 6 –Wastewater Treatment in Potato Chips Industry *July 01, 2023*

Dear Water Warriors,

The potato industry is well known for the vast quantities of organic wastes it generates. Treatment of industrial effluents to remove organic materials, however, often changes many other harmful waste characteristics.

Proper treatment of potato processing wastewaters is necessary to minimize their undesirable impact on the environment.

This issue of 'Waughter', we discuss the wastewater treatment in potato chips industry.

Nidhi Jain
Civil Engineer

In this edition we cover up the different wastewater treatment practises for potato chips industry along with need of ZLD .

Q. Introduction to chips making process

Q. Influent types & characteristics

Q. Treatment map

Q. Why is EQ placed after Preliminary Treatment?

Q. Role of Bio Tower & UASB

Q. Effect of Longer Peel residence Time

Q. RO water use for cooling tower & boiler

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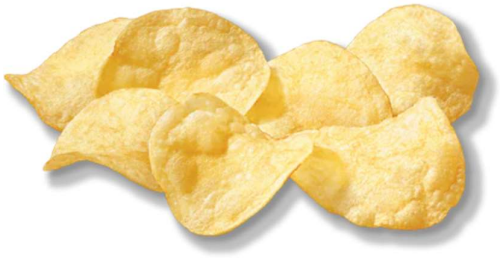
Introduction

Potatoes are rich in many kinds of amino acids, carbohydrates, and many kinds of vitamins that human body needs.

After being fried and added the variety of natural food additive, the fried potato chips not only keep the nutritional ingredients above but increases vitamin A, amino acids, and a variety of minerals.

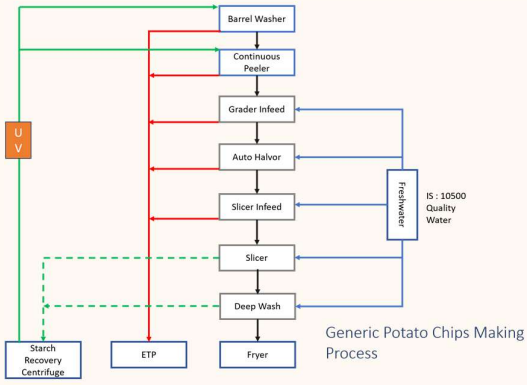
Potato chips are famous for their delicious, crispy taste and rich nutrition. It became one of the main popular leisure foods for decades.



Introduction to Chips Making Process

These are main steps of potato chip making process line.

1. Preparation
2. Slice Washing



Generic Potato Chips Making Process

3. Blanching (Optional)
4. Multi Zone Frying
5. Flavour Addition
6. Packaging

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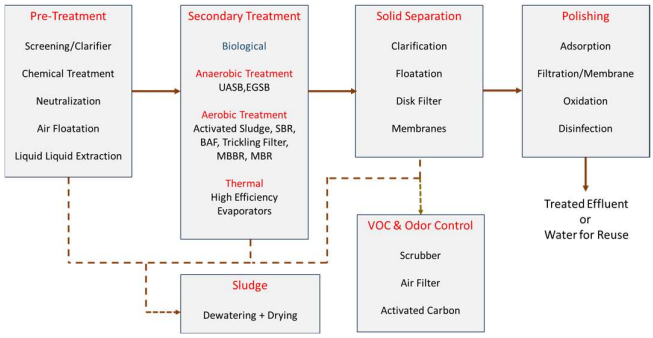
Influent types & characteristics

Potatoes contain approximately 18% starch, 1% cellulose, and 81% water, which contains dissolved organic compounds such as protein and carbohydrate.

In above discussed chips making industry we get pollutant like peal, pulp, sand, TSS, Ph, FOG, BOD, COD, NH3N, TDS, Fryer oil, Pest Control, Drainage etc. Two types of streams get collected in ETP.

One stream consists of low TDS and TSS, COD, BOD, potato peel, pH etc. and is majorly known as starch water stream. Whereas second stream that is mainly washing & CIP has high TDS, FOG, TSS, COD, BOD and pH less than 7.

Treatment map



An integrated waste treatment system usually consists of three phases: primary treatment, secondary treatment, and advanced treatment.

Primary treatment involves the removal of suspended and settleable solids by screening, flotation, and sedimentation. Secondary treatment involves the biological decomposition of the organic matter, largely dissolved, that remains in the flow stream after treatment by primary processes.

Biological treatment can be accomplished by mechanical processes or by natural processes. The flow from the biological units is then passed through secondary sedimentation units so that the biological solids formed in the oxidation unit may be removed prior to the final discharge of the treated effluent to a stream.

In all cases, great importance should be given to the steps that contribute to reducing the waste load in the plant itself.

Why is EQ placed after Preliminary Treatment?

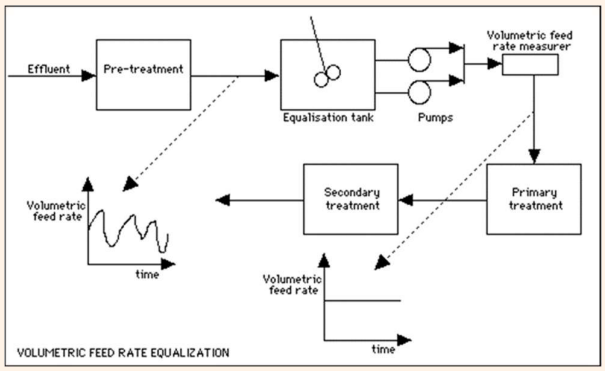
Equalization is done to serve one simple purpose of providing Linear propagating feed to downstream process at Constant Flow.

Placement of an equalization tank following primary treatment minimizes operation and maintenance, and minimizes requirements for solids removal, aeration, and odor control equipment.

In the case of potato processing wastewater, the mechanically pretreated or pre clarified wastewater flows into a balancing tank (buffer tank). Equalization serves two purposes:

1. Physical homogenization (flow, temperature)
2. Chemical homogenization (pH nutrients, organic matter, toxicant dilution)

For proper homogenization and insurance of adequate equalization of the tank content, mixing is usually provided, such as turbine mixing, mechanical aeration, and diffused air aeration. The most common method is to use submerged mixers.



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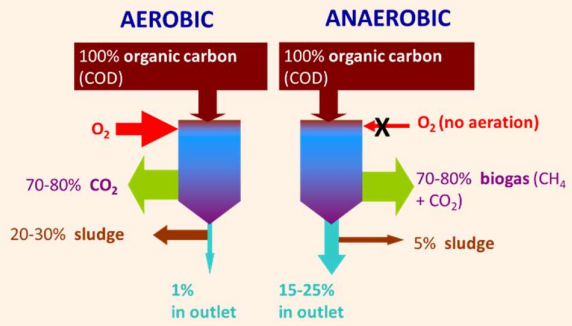
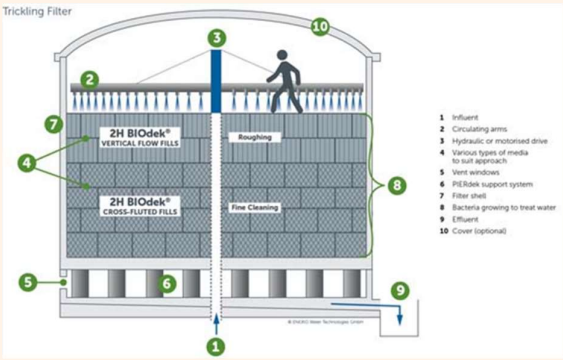
Role of Bio Tower & UASB



Aerobic treatment of wastewater is a biological process that uses oxygen to break down organic contaminants and other pollutants like nitrogen and phosphorous.

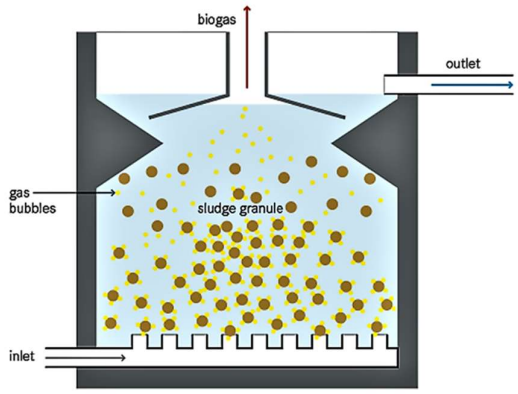
Bio-Tower, ASP, MBR, MBBR, FBR etc. are example of aerobic biological treatment.

Bio-towers ideally suited to break down pollutants such as ammonium and nitrite dissolved in the water. They are used after a mechanical pre-filter such as a sieve or drum filter. Bio towers use plastic media for increasing the specific surface area of the biological action.



In potato processing industry pretreated effluent and re- circulated flow enters the trickling filter or bio-tower through distributor arms.

The distributor arms circulate and evenly spread the wastewater across the top of the media. The wastewater then flows down through the media, where it is treated by the bacteria attached to the media and exits the trickling filter or bio-tower.



Up flow anaerobic sludge blanket technology also known as UASB reactor is a form of anaerobic digester which is used in wastewater treatment.

It is a methane-producing digester, which uses an anaerobic process and forming a blanket of granular sludge and is processed by the anaerobic microorganisms.

Wastewater flows upwards through the blanket and is processed (degraded) by the anaerobic micro-organisms. The upward flow combined with the settling action of gravity suspends the blanket with the aid of flocculants.

However, Aerobic treatment has some distinct advantages over the anaerobic treatment process.

These include reduced odor (due to non-production of hydrogen sulphide or methane) and better nutrient removal efficacy (facilitating direct discharge into surface waters or disinfection).

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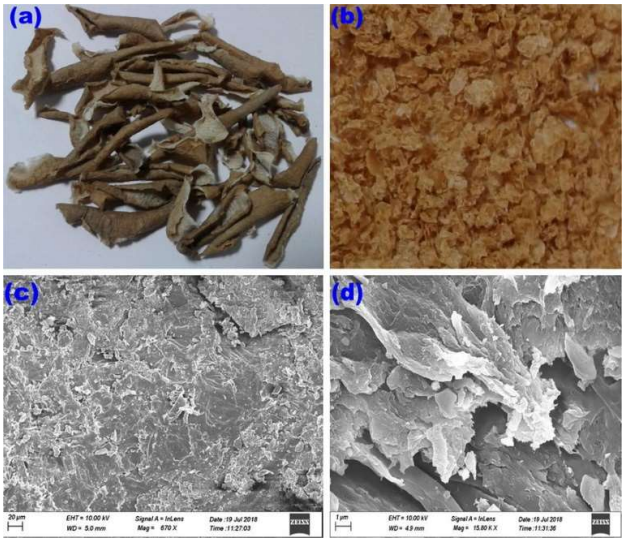
Effect of Longer Peel Residence Time



Residence time is a key parameter in designing technologies, since it can describe the unit processes without using the dimensions of the plants, basins, or reactors.

In wastewater treatment the detention time can be defined for water Hydraulic Residence Time (HRT) and for solid fraction Sludge Residence Time (SRT).

Besides the SRT, other time-related parameters can be defined. One is sludge age, which is calculated as a ratio of the total solids in aeration tank to the weight of total solids in the aeration tank influent.

In Potato industry there is chances of peel to bypass screen due to inefficiency of screen equipment to handle flow of effluent. Peel comes to aeration tank and start getting degraded.

Failing to remove sludge at a fixed rate. These peels start releasing lignin colour to effluent which in result make treated water yellowish in colour along with odor. Colour appears due to degradation of Peel.

Complexity increases in equipment treatment due to higher sludge age. Peel gets deposited on MBR as well as in Bio Filter. One must address Peel for avoiding biological problems.

RO water uses for cooling tower & boiler

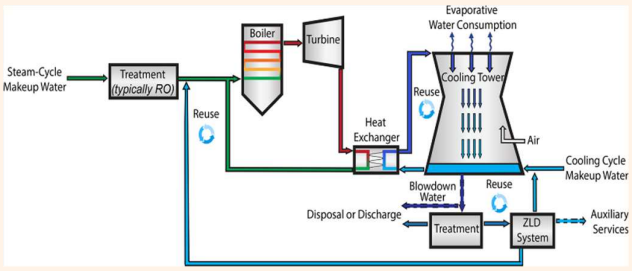
Sources of boiler feedwater include returning condensate and makeup water. “Makeup water” simply means the H2O added to plant processes to compensate for lost water.

Boiler’s makeup water quality is critical because it can impact the whole system. One way of improving feedwater quality and avoiding fouling, scaling, and corrosion is through reverse osmosis (RO).

RO uses a partially permeable membrane to eliminate unwanted ions, molecules, and larger particles from water. By removing up to 98% of the impurities and dissolved solids, it can reduce the conductivity of the boiler makeup water from 700 uS to 14–35 uS.

This would in turn allow to reduce the blowdown rate from 20% of makeup water to 1%, conserving water and energy. Removing these impurities also improves the quality of the steam. By using RO water in Boiler & Cooling Tower:

1. Higher cycles of concentration result in reduced fuel costs.
2. Improved steam purity and quality for increased corrugator speed.
3. More efficient operations and increased throughput results in higher revenue/profit.
4. Reduced risk of carryover in the steam, along with deposits in the boiler and downstream equipment.
5. Improved condensate corrosion control (no alkalinity in the boiler to produce CO2 for carbonic acid formation).
6. Maintains optimal thermal performance, resulting in improved heat transfer in steam boilers.



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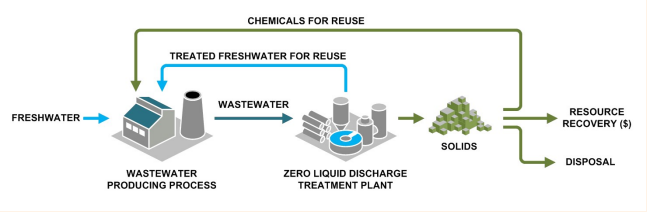
Why need of ZLD?

In India, the CPCB has advised to install the ZLD system to all industries and made it mandatory to reuse the water after treatment.

Zero liquid discharge (ZLD) is an engineering approach to water treatment where all water is recovered, and contaminants are reduced to solid waste. The focus of

Salinity, scaling compounds, and organics all increase in concentration, which adds costs associated with managing these increases. ZLD is achieved by stringing together water treatment technology that can treat wastewater as the contaminants are concentrated.



Targeting ZLD for an industrial process or facility provides a number of benefits:

1. Lower waste volumes decrease the cost associated with waste management.

2. Recycling water on-site lowers water acquisition costs and risk. Recycling on-site can also result in fewer treatment needs, versus treating to meet stringent environmental discharge standards.

3. Reduce trucks associated with off-site wastewater disposal and their associated greenhouse gas impact and community road incident risk.

4. Improve environmental performance and regulatory risk profile for future permitting.

5. Some processes may recover valuable resources, for example, ammonium sulfate fertilizer or sodium chloride salt for ice melting.

जल जीवन जननी !!

Our World is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead.

Our next edition focuses on: “Waste Water Treatment Plant Design – Textile Processing”

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