

## THE SABIAN LINE OF BLACK WALNUT SHELL FILTERS

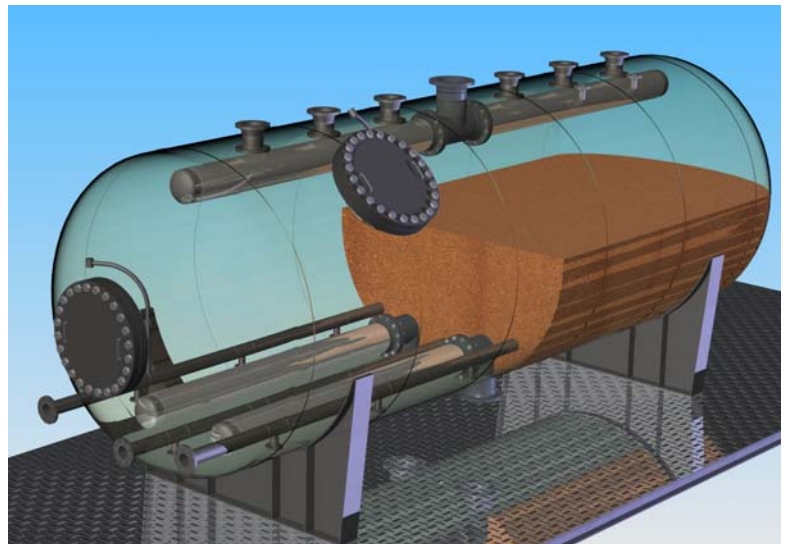
The SABIAN™ Black Walnut Shell (BWS) Filter technology presents a solution that is credible, competitive and simple to operate and maintain. We can help to provide a higher return on investment than our competitors, and usually meet or exceeds the minimum desired Oil-in-Water and Total Suspended Solids (TSS) targets.

The filters objective is to clean the water sufficiently for downstream applications, and to remove the smallest droplet size possible, even during upsets. These downstream applications may include injection into formations, chemical precipitation softening, silica reduction, steam generation or direct disposal.



Walnut Shell Filtration is a technology that uses the nutshell media to provide a large adsorption area with easy adhesion of oil to the nutshell's surface. The media exhibits good solids retaining capacity and the presence of oil acts to increase the solids removal efficiency. The media selected is sourced from Black Walnut Shells which unlike English Walnut shells are much harder and durable for this service.

During the filtration process water enters near the top of the vessel and flows down through the nutshell bed. Filtered water flows down through the bed, through the support screen and exits near the base of the vessel, whilst oil droplets and solid particles are trapped within the media. To clean the media the vessel will periodically “backwash”. During this process oil is stripped from the media, which is then re-deposited inside the vessel and the process is repeated. The unit will backwash automatically when either the differential pressure across the bed is exceeded or a pre-set running time is reached. The reason why this is possible is due to the wetness capability of the walnut shells. Walnut shells have a very high wetness capability (i.e. they like attaching to water). The oil is caught by the shells but since they have high water wetness the oil can be flushed in backwashing and the shells are ready once more.



The Sabian BWS filters are capable of handling a large variety of flow rates and can perform in a wide variety of situations. The benefit of this flexibility is the ability to design the optimal operating guidelines of this process for field implementation.

## **UNIQUE DESIGN FEATURES**

With the Sabian Filter's unique patent-pending design, no standby time is required for backwash, backwash volume is low and flow patterns are such that filtration surface area is optimized and no settling dead zones occur during the backwash process.

Sabian BWS filters are configured in three potential arrangements **a)** single chamber vertical units for flows up to 60,000 bwpd, **b)** single chamber horizontal units for flows higher than 60,000 bwpd and **c)** multiple chamber horizontal units for high flow rates or customer requirements for redundancy. Multi chamber configurations range from 2-4 chambers depending on the flow rate requiring treatment. During operation several chambers are dedicated to filtration while one chamber remains in standby mode so it is always available to receive inlet water when a backwash cycle begins. Each chamber runs through a rotation cycle so that each chamber alternates its role as the standby. This type of operation eliminates the need for spare filters.



## **PROCESS DESCRIPTION**

The water enters near the top of each filter or filter chamber through nozzles designed to promote even distribution through the depth of the filter bed. Filtered water flows down through the bed, through the support screen and exits near the base of the vessel. Oil droplets and solid particles are retained within the media.

The filtration process continues until the media becomes substantially fouled, causing a 20 psig pressure drop within the system, or when a preset running time is reached, at which point, the filter or chamber (in the case of multi chamber filters) is backwashed to clean the media. During the backwash cycle inlet water is diverted to the backwash jets for fluidization, thereby the full design volume is always processed through the unit. Use of the inlet water for backwash eliminates the need for a backwash pump. No additional water is added to supplement the backwash which eliminates the need for a storage tank as required in some competitors designs.

This simple process is a pure hydraulic operation, taking advantage of the fact that Black Walnut Shells are "Water Wet" and shed the oil and solids during the agitation of the shells. During the backwash cycle, a multiphase mixture of inlet water and compressed gas (or air) exits the backwash jet to agitate settled walnut shells and fluidize to wash the bed. The backwash volume is very low relative to most competitive designs due to the use of the buoyant inlet gas aiding in the agitation process. After sufficient agitation occurs to clean the media, backwash water exits through a screen, located near the top of the chamber and is subsequently pumped to storage or disposal.

After backwash the media is allowed to settle back into place for a short period of time prior to water transfer through the chamber. Following this period, a small volume of inlet fluid is added through the inlet nozzle to set the bed. This fluid is diverted back to the inlet of the upstream flotation process and hence reintroduced to the inlet flow to be treated. On completion of this process stage the filter begins back in full filtration mode.

## THE SABIAN BWS FILTER FAQ

### **1. What is Unique About the Sabian BWS Filter compared to Other Nutshell Filters ?**

- Low backwash volumes
- Media is cleaned inside the filter itself and no outside transfer is necessary
- No rotating equipment is necessary, ie. Backwash pump or mixer
- Lower operating costs as no power is required for a backwash pump or mixer
- Simple control philosophy, easy to operate with high reliability
- Filter is of a Robust design, with low life cycle cost
- Longer media life than competitors' products, which use nutshells other than Black Walnut
- Built in Redundancy through multi chamber design incorporating a spare chamber, therefore surge capacity is not required upstream and also leaves room in the future to handle additional flows provided surge is added.

### **2. What Nutshell Media is used inside the Sabian BWS Filter ?**

Only Black Walnut Media of the highest quality is utilized this media due to its physical properties including:

- Wettability Optimal for Oil Coalescence
- No long term Binding of Coalesced Oil to the shell media , allowing for effective cleaning
- Specific Gravity Close to that of Water making Backwash Agitation Efficient
- Uniformity of Particle Size
- High Modulus of Elasticity , highly resistance to deformity or fracturing during backwash

### **3. Are Any Chemicals Required ?**

Media regeneration is a completely hydraulic physical process with NO requirement for chemicals

### **4. What is the Partical Removal Efficiency?**

The Sabian BWS can retain 98% of particles 2 micron and higher

### **5. How is the Media Backwashed ?**

The backwash is unique in that no backwash pump nor rotating mixing device is used. The shell media remains inside the vessel for the entire backwash cycle agitated by hydraulics of liquid and gas flows. The energy for this backwash comes from the filter feed pump (dirty water) and from a small air or gas compressor included within the filter package. Patent pending internal arrangement and nozzles create the jet patterns necessary to fluidize the bed during the agitation stage.

### **6. Where Does my Inlet Water go While I am Backwashing & do I need Upstream Surge Capacity ?**

The Sabian BWS Filter utilizes the inlet water "filter feed" for backwash purposes so in single chamber units no redundant filter is required. For the multi-chamber horizontal design one chamber is continuously in "standby" mode. When it is time for an operating chamber to backwash the inlet flow is simply diverted to the standby chamber. This design means that a second filter is no longer required nor is it necessary to design for upstream surge capacity within the plant.

### **7. What Flow Rates are the Sabian BWS Filters Available in ?**

Sabian BWS Filters are available from small 1,000 bwpd test units to single commercial packages treating 300,000 bwpd. Larger flows are accommodated through the use of parallel treatment trains.