Processing of Crude Palm Oil

Machines and process lines from GEA Westfalia Separator
The Perfect Combination: Economic and Ecological Sustainability

GEA Westfalia Separator supports conventional and innovative process management for processing crude palm oil. The process lines are convincing in economic and ecological terms.

Palm oil is a commodity which is in demand throughout the world. It plays an important role in the food industry, which has traditionally needed palm oil for the production of margarine, confectionery or ready meals. The valuable oil has also been used for a long time in the production of washing agents, soap, candles, cosmetics or technical fats. With the additional use of palm oil in the production of biodiesel, the significance of this commodity has now assumed a new dimension: In this particular sector, palm oil has overtaken all other vegetable oils, and is now the main commodity used in the production of this alternative fuel.

Maximum performance in non-stop operation

The oil is obtained from the fruit of the oil palm, which finds optimum growing conditions in tropical countries with a constant climate. The main producer countries are Indonesia and Malaysia in South East Asia. However, increasingly large plantations are also cultivated in South America and Africa. The oil is processed throughout the year in non-stop operations. The machines and process lines must be correspondingly resistant and robust.

GEA Westfalia Separator supports all procedures and processes for recovering palm oil. The continuously operating technology combines extremely robust design with high product yield and excellent oil quality.
Palm oil is nowadays the most produced vegetable oil, even ahead of soya oil. Because of its high carotin content, the crude oil which is obtained from fruit bunches of the oil palm has an orange-red color, which is removed in the subsequent refining process.

In addition to cost-effectiveness, GEA Westfalia Separator is setting new standards in terms of environmental compatibility with the development of the new Westfalia Separator® eco-d system. Any negative impact on the environment as a result of climate-unfriendly methane or organically contaminated waste water is considerably reduced. In the Westfalia Separator® eco-d system, everything focuses on achieving minimum process times, making efficient use of resources and significantly improving cost-effectiveness also by way of using all resources of the valuable by-products. Decanters, separators and additional components such as automatic de-sanding systems, rotary brush strainers and vacuum driers can be combined as required to form an entire line which meets all the individual requirements of operations.

All benefits at a glance:
- Flexible adjustment to all procedures and processes
- Continuous process management
- Robust technology
- Top oil quality
- Highest product yield
- Better environmental compatibility with the new Westfalia Separator® eco-d system
Conventional Process with Vertical Clarifier and Nozzle-Type Separator

Conventional processes for recovering crude palm oil operate with vertical clarifiers in which the oil is separated from the sludge. The oil remaining in the sludge is efficiently recovered with nozzle-type separators or 3-phase decanters from GEA Westfalia Separator.

In conventional processes, the palm fruits are desanded and pressed with the addition of dilution water. The heart of the downstream process stages are large settling tanks, so-called vertical clarifiers (VC) in which the crude oil settles out of the sludge. The conventional process with vertical clarifiers operates reliably, however other processes may offer more advantages in terms of oil losses, space and environmental issues.

Cost-effectiveness can be considerably improved by recovering residual oil from the settled sludge. Nozzle-type separators from GEA Westfalia Separator provide a possibility of recovering the palm oil. They separate the sludge into three phases: Palm oil, solid concentrate and water, which is recycled back into the process as dilution water.

All benefits at a glance:
- Sludge deoiling in a continuous process
- Increased palm oil yield
- Reduction of the sludge to be disposed of
- Automatic CIP process
- High speed, high performance
Conventional Process with VC and Westfalia Separator® topd 3-Phase Decanter

The use of the new Westfalia Separator® topd 3-phase decanter is an alternative to the nozzle-type separators.

Instead of a nozzle-type separator, a Westfalia Separator® topd 3-phase decanter can be used downstream of the vertical clarifier. This 3-phase decanter combines the economic advantages of a decanter – namely high throughput capacities in a continuous process – with much drier solids.

The 3-phase decanter separates the sludge which contains oil into an oil phase, solids and virtually oil-free waste water. Because of its high dry matter, the solids can be recycled relatively easily. In addition, the solids concentration in the waste water is lower than would be the case if nozzle-type separators are used.

A further benefit of the Westfalia Separator® topd decanter is the lower fresh water requirement in comparison to nozzle-type separators.

In order to process the crude oil from the vertical clarifier, it is also possible to install a purifier which efficiently and reliably removes minimum contaminants from the oil.

All benefits at a glance:
- Lower cake transportation costs due to very dry solids
- Better recovery of nutrients due to very high separation efficiency
- Lower fresh water consumption compared to other processes
- Continuous and fully automatic operation
Oil Recovery from Sterilizer Condensate

The processing and recovery of oil from sterilizer condensate with separators from GEA Westfalia Separator provides additional profitability.

Diagram description:
- Sterilizer
- Condensate
- Empty bunch process
- Heavy phase clarification station/press
- Retention tank
- Water balance tank
- Hot water tank
- Feed tank
- To gutter
- Brush strainer
- Nozzle separator
- Nozzle discharge
- Collecting tank
- LP with ≥ 85% Oil to clean oil tank
- LP with ≥ 50% < 85% Oil to decanter feed
- 1% < FREE OIL < 2%
- To effluent
- To gutter
GEA Westfalia Separator has developed an additional process stage in order to improve the profitability of the conventional process by recovering residual oil from the sterilizer condensate.

In conventional processes with vertical clarifier, large quantities of water are generated in the processes of sterilization, pressing and processing the empty fruit bunches. The sterilizer condensate occurs in the form of waste water which contains oil and extremely fine particles. Waste water has not been processed in the past so this new process stage with a nozzle-type separator of GEA Westfalia Separator in a bypass increases the oil yield. Because of its specific design, the nozzle-type separator is able to recover the palm oil which is contained in the sterilizer condensate. The recovered oil can be recycled back into the main process. This means less oil losses in the overall process. The volume of waste water is also considerably reduced.

All benefits at a glance:
- Continuous process stage
  in a bypass arrangement
- Increased overall yield
- Reduced volume of waste water
- CIP not necessary
- High speeds, high performance
Crude Oil Process with Westfalia Separator® topd 3-Phase Decanters

The crude oil process with 3-phase decanters does not need vertical clarifiers and sludge tanks.

The pressed and de-sanded palm oil in this process is sent directly to the Westfalia Separator® topd 3-phase decanter. The main advantage is to be seen in a much shorter process time and lower oil losses. The risk of oxidation of the crude oil is also less significant compared to the process using vertical clarifiers. Because the large-volume tanks are not necessary, the dimensions of the process lines can be much smaller. Due to lower dilution water requirements, valuable fresh water is saved.

All benefits at a glance:
- Shorter process time
- Minimum space requirement
- Lower fresh water requirement
- Higher oil yield
- Lower oxidation risk
- Lower volume of waste water compared to the conventional process
- Continuous and fully automatic operation

The 3-phase decanter separates the pressed crude oil mixture into an oil phase, a dry solids cake and virtually oil-free waste water. The oil phase is sent to a purifier, which polishes the palm oil and reliably removes even extremely small contaminants.
Westfalia Separator® ecod System – with 2-Phase Decanters

With the Westfalia Separator® ecod system for the crude oil process, GEA Westfalia Separator has developed the most innovative process currently available on the market.

The Westfalia Separator® ecod system combines extremely short process times and significant environmental compatibility with excellent product quality as well as a significant reduction in oil losses and fresh water requirement. The system needs only a minimum of dilution water. Vertical clarifier and sludge tank are not necessary. In this way, the process time is considerably reduced, and the energy consumption is also lower. The amount of effluent is reduced to less than 25 percent in relation to the volume of processed fruits. This is nearly half the quantity created in the conventional process.

In conventional processes, huge ponds are necessary in order to handle the effluent which is very organically contaminated. These ponds release large quantities of the greenhouse gas methane, which is more than 20 times more problematical for the climate than carbon dioxide. The Westfalia Separator® ecod system considerably reduces the methane problem because the ponds are much smaller. The formation of methane is reduced to such an extent that the palm oil millers are able to sell CO₂ certificates via emission rights trading and are thus able to generate additional profit.

The three main components of the system are an automatic de-sanding system (multicyclone), a special Westfalia Separator® ecod decanter as well as a high-performance purifier. The decanter system generates two phases from the crude oil: Clean oil and an NOS/fruit water mix, which contains almost 100 percent of the nutrients.

A separate waste water phase that is created in the conventional process, is eliminated. As a result of the special rotor design, the highly viscous crude oil can be separated in one process stage with almost no dilution water.

In the Westfalia Separator® ecod system waste water is only created in the upstream sterilization stage. If required, this can be purified with the aid of nozzle-type separators or it can be used for the composting process.

The oil which is recovered in this way is sent via a heating tank to the self-cleaning separator, which removes the remaining solids entirely from the palm oil. The oil is then dehydrated in a vacuum drier and put into storage. The slurry can be mixed with the empty fruit bunches and be composted. If the palm oil mill has a demand or a market for biogas/energy, the POME (sterilizer condensate and decanter biomass) can be treated in a biogas plant. For this kind of POME with high dry matter content totally mixed digesters are necessary. The mass is turned on several occasions whereby the water is evaporated, resulting in a valuable fertilizer which can be used for the plantation or for selling.

All benefits at a glance:
- Simplified process with high environmental compatibility for sustainable production
- Extremely short process time
- Virtually no dilution water
- Low energy consumption
- No vertical clarifier and sludge tanks
- Much smaller ponds – considerably reduced methane formation
- Possibility of selling CO₂ certificates
- Higher product yield
- Palm oil in premium quality
- Recycling of nutrients
- Increased FFB production by organic fertilizer
Westfalia Separator® eco decanter

Biomass

Biogas recovery (Slurry, Sterilizer condensate)

Composting (EBB, Slurry, Sterilizer condensate)

Nozzle separator

Oil back to process

Vacuum drier

Purifier

Sludge

Reheating tank

Condensate

Steam

Biomass

Steam Condensate

Press

Sand trap

Vibrating screen

Fibres

Buffer tank

Pump

Pump

Pump

Live steam

Feed tank

Pump

Desander

Sand

Desander

Oil to storage

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GEA Westfalia Separator
Westfalia Separator® eco Decanter

With the special rotor design of the Westfalia Separator® eco decanter palm oil can be recovered with a minimum of dilution water.

In the production of palm oil, decanters form the heart of every modern process line. The decanters of GEA Westfalia Separator feature the know how gained in more than 115 years of experience in the development of centrifuges. In addition to the increased product yield, producers of palm oil particularly appreciate the robust design of the decanters, which is particularly important in intensive and hot non-stop operations. High product reliability and maximum availability make the decanters of the technology leader in centrifugal separation technology the international first choice.

The Westfalia Separator® eco decanter is one of the most efficient developments in this respect. The special rotor of this innovative 2-phase separating decanter can process the highly viscous crude oil in a single process stage. Model versions are available for processing up to 35 tonnes FFB per hour.

All benefits at a glance:
- Robust quality – made in Germany
- High process reliability – maximum availability
- Simple operation and control
- High efficiency – excellent ROI
- Maximum product yield

Water and solids
Westfalia Separator® topd 3-Phase Decanter

In the conventional process with a vertical clarifier or in the crude oil process, the Westfalia Separator® topd 3-phase decanter provides efficient and cost-effective operation.

The Westfalia Separator® topd 3-phase decanter separates the liquid-liquid-solids mixture into an oil phase, solids and waste water. This decanter series is designed for maximum separation efficiency and is equipped with an exceptionally long and slender rotor system. This enables high throughput capacities to be achieved in a continuous process, as required in non-stop operations for recovering palm oil. The Westfalia Separator® topd 3-phase decanter also produces solids with a dry matter which is very high compared with conventional 3-phase decanters. The solids can thus be easily disposed of. Moreover, there are considerably lower volumes of solids in the waste water. Because the fresh water requirement in this development has also been reduced, the Westfalia Separator® topd 3-phase decanter supports an economic operation which makes efficient use of resources.

All benefits at a glance:
- Low oil losses
- Very dry solids
- Robust quality – made in Germany
- High product reliability – maximum availability
- Simple operation and control
- High efficiency – excellent ROI
- Maximum product yield
High Speed Nozzle-Type Separators

An economic alternative in the conventional process with a vertical clarifier

The task of the nozzle-type separator is to continuously recover palm oil from the sludge which contains oil and which is fed to the separator from the vertical clarifier. These nozzle-type separators feature high throughput capacities, a very robust design, low space requirement, a high degree of automation and (compared with decanters) lower investment costs.

All benefits at a glance:

- Continuous operating mode
- Automatic operation
- Low manpower requirement
- Low space requirement
- High speed – high efficiency
Purifier VSD Series

Purifiers from GEA Westfalia Separator assure premium quality of CPO by removing all residues in conjunction with extremely gentle product treatment.

In order to recover extremely pure palm oil, special purifiers are installed downstream of the decanter stage. The purifiers of the VSD series are ideal for this particular task. Because of their high separating efficiency, they separate all undesirable solids reliably and efficiently from the palm oil. All models in the VSD series are state-of-the-art. The self-cleaning purifiers reduce the amount of maintenance to a minimum, provide extremely gentle treatment for the oil and, with the Westfalia Separator® hydrostop system, ensure optimum product yield. With this system, the partial discharges can be adjusted so precisely that the liquid is retained in the bowl when solids are ejected, thus avoiding product losses.

All benefits at a glance:

- Westfalia Separator® hydrostop system for higher product yield
- Self-cleaning
- Improved clutch design – for a longer wear lifespan
- All components which come into contact with product are made of stainless steel
- Flat-belt drive for low maintenance
- Higher g-force
- Automated operation
- Continuous processing mode
- Simple maintenance
- Low-noise design
Auxiliary Equipment

Multicyclone systems, rotary brush strainers and vacuum driers complete the product range.

The components presented at this point turn the range of decanters and separators of GEA Westfalia Separator into complete process lines.

Multicyclone systems
The crude oil has to be desanded before it is fed into the centrifuges so that erosion problems which are caused by the sand can be avoided. This stage is handled in a simple and reliable manner with the fully automatic multicyclone systems of GEA Westfalia Separator. All components which come into contact with product are made from wear resistant materials, and are thus extremely robust.

All benefits at a glance:
- Fully automatic principle of operation
- Optimum sand separation with uniform feed conditions
- Components which come into contact with product are made from wear resistant materials
- Available in many automatic configurations
Rotary brush strainers
The use of upstream rotary brush strainers is recommended whenever nozzle-type separators are used, in order to prevent the nozzles from becoming clogged with coarse particles.

All benefits at a glance:
- Conditions the suspension to facilitate discharge through nozzles
- Automatic self-cleaning

Vacuum driers
The palm oil which is recovered is dehydrated in a final process stage. For this purpose, GEA Westfalia Separator provides various vacuum driers which meet all requirements in terms of efficiency and effectiveness.

All benefits at a glance:
- Automatic and continuous principle of operation
- Optimum evaporation of residual humidity in the palm oil
- No oxidation
- Short process time
- Low energy requirement
Westfalia Separator® capital care –
Maximum Process Efficiency, Installation
Availability and Budget Security

Westfalia Separator® capital care –
maximum process efficiency, system availability and budget reliability

Wherever separation technology jobs need doing, Westfalia Separator® capital care ensures comprehensive services right from the start. We collaborate closely with our customers to work out solutions tailored to their precise requirements.

In the process, partners benefit not only from classic services such as servicing, maintenance, original spare parts and repairs by the original manufacturer, but also from proactive risk management solutions – such as online and offline monitoring with Westfalia Separator® wewatch®.

Modernization or upgrading to the state of the art in tandem with the process furthermore provide the option of increasing performance if required.

The customer’s staff are trained to handle the high-tech plant correctly in on-site training sessions or in GEA Westfalia Separator’s modern training centre. This provides additional peace of mind.

Authorized workshops worldwide
If problems do ever occur, or a spare part is required quickly, the specialists can be with the customer immediately. This is guaranteed by a global network of over 50 sales and service companies, as well as another 60 sales partners. Authorized workshops are able to serve any location in the world at short notice.
This is how Westfalia Separator® capitalcare ensures maximum process efficiency and system availability as well as budget reliability – throughout the entire life cycle of the system.

Original manufacturer service:
- Service engineers rapidly on site
- Close-knit service network
- Original manufacturer service for risk management
- Proactive, risk-avoiding solutions
- Upgrades to increase performance
- Staff training

In addition to classic services such as maintenance or repair, Westfalia Separator® capitalcare also provides risk management solutions to secure the availability of systems proactively.
The information contained in this brochure merely serves as a non-binding description of our products and is without guarantee.

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