metals industry
TRENDS & EVENTS
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MIRDC Sets Intervention Programs to Benefit M&E

MIRDC is taking bolder steps to formulate new approaches, strategies and programs as well as to develop practical and effective answers and solutions to the needs and problems of the M & E industries.

This objective lead MIRDC to hold a consultative meeting last 28 November with its key stakeholders (e.g. MIRDC Governing Council members, Industry Association representatives, and PCIERD) on a proposed MIRDC Strategic Plan (2008-2020) which includes the M&E Industries Development Plan as among its major components.

The consultation was designed to establish a common position in seeing a similar direction based on agreed upon priorities that will enable MIRDC to meet the current challenges as well as the prevailing and emerging demands and requirements of the industry.

The consultation brought together comments and suggestions from the top representatives of M&E.

Four major sectoral intervention programs identified during the consultation are:

1. Enhancing Manpower Development Program
   - 1.1 Comprehensive Training Program on Design & Engineering of Machineries and Component Parts (Agricultural Machinery and Equipment; Industrial Machineries; and Energy-related equipment)
   - 1.2 Trainers Development (Machine Design; Welding; CNC Programming and Operations; and Failure Analysis)

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MIRDC Welcomes DOST ARDs and PSTDs

Participants to the "Enhancement of Technical Capabilities of the DOST Provincial S&T Directors (PSTDs) and Assistant Regional Directors (ARDs) Through Experiential Learning Program at DOST RDIs" were welcomed by the top executives of the Center last November 10 & 24, 2008. After presenting to them the MIRDC profile, the participants were able to tour the Center's facilities at the metalcasting, metalworking, and heat treatment shops as well as in the mechanical, instrumentation, and chemical laboratories. The Center also conducted technology demonstrations on brushplating, spincasting, and coco coir processing.

The nine-day experiential learning program for the PSTDs and ARDs integrates orientations and study tours to DOST's research and development institutes (RDIs) and sectoral planning councils such as the Advanced Science and Technology Institute (ASTI), Food and Nutrition Research Institute

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In this issue

From the Executive Director.....

Holiday greetings!

Following the success of the National Science and Technology Week (NSTW) of the Department of Science & Technology (DOST) at the World Trade Center Metro Manila, MIRDC also participated in a series of exhibitions in regions II, III and VII, such as in Tuguegarao, Cagayan; Tagbilaran City, Bohol; Olongapo City and Subic, Zambales during the last quarter of 2008. The coco coir processing technology equipment were showcased and drawn interest from students, researchers and industry players. Moreover, our research and development projects are still on-going such as the further development of other coco coir-related equipment. As for the Jathropa Oil Processing Technology, the equipment are at their fabrication stage. One of our R & D experts stated that such technology is proliferating and more provinces are interested to implement it for their economic programs.

In cooperation with the Industrial Technology Development Institute (ITDI) to enhance technological capabilities of other DOST agencies, the Center conducted facility tour with technology demonstrations on brushplating, spincasting and coco coir processing. It was attended by Provincial Science and Technology Directors (including other Provincial S & T staff) and Assistant Regional Directors.

With our new vision and renewed passion, MIRDC management finalized strategic plans in Baguio City held early December. Before this activity, different committees were formed and series of deliberations were convened to evaluate various plans and programs for the next five years 2009-2013. Related to this, a consultative meeting with the key stakeholders was held, gathering the key officers of the different associations in the metals and allied engineering industry and tackling various issues being faced by the industry. The management presented and documented the strategic plan until 2020 towards a dynamic and competitive M & E industry.

The Center highly appreciates our key stakeholders in the Metals and Allied Engineering Industry specifically from the Philippine Die and Mold Association (PDMA), Metalworking Industry Association of the Philippines (MIAP), Agricultural Machinery Manufacturers and Distributors Association (AMMDA), Mechatronics and Robotics Society of the Philippines (MRSP), Philippine Welding Society (PWS), Society of Manufacturing Engineers (SME), Metal Engineering Industry Foundation, Inc. (MEIFI), Philippine Metalcasting Association, Inc. (PMAI), and Philippine Iron and Steel Institute (PISI) who have shown solid support by participating in a Consultative Meeting at MIRDC on 28 November 2008. Further, the Center acknowledges the Machining Sector respondents of the on-going survey for machine shops.

We are also very grateful for the tough support of our Governing Council members. Looking forward to their dedicated involvement for the success of implementing the strategic plans of the Center.

Rolando T. Viloria, CEO III
Executive Director

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A Joyous Christmas Celebration at MIRDC

A high-spirited Christmas celebration of MIRDC was held on the 17th day of December. It started with a mass officiated by Father Bart Bacsal coupled with inspirational message to ponder on this special occasion. Although a simple celebration, it brought excitement, surprises, and fun to MIRDC employees. Sumptuous meals at the "salu-salong kainan" was enjoyed by everyone, savoring the belongingness and closeness with each other.

The program moved with games that induced camaraderie among employees and raffles so everyone has something to bring home. There was also a bingo social that was hosted by SALEM officers that made the crowd shouts and thrills to what prizes were at stake for the winners.

Awarding of Loyalty Certificate for employees who served the Center for 15, 20 and 30 years was also held in due recognition for their unwavering dedication as public servants. Such recognition was conferred by MIRDC Deputy Executive Director Arthur Lucas D. Cruz, Mrs. Mercedita G. Abutal and Mrs. Carmen G. Quiambao.

The MIRDC 2008 Christmas celebration was really a worth remembering event for its employees.

Snapshots during the MIRDC 2008 Christmas celebration

MIRDC Joins Cluster Fairs

This last quarter of 2008, the MIRDC joined annual cluster fairs organized by the Department of Science and Technology (DOST). The exhibitions were also held as part of activities to commemorate the golden anniversary of the Department.

The first in a series of exhibitions was the 4th Northern Luzon S&T Cluster Fair held from 06-10 October 2008 at the Cagayan Colleges Tuguegarao (CCT) Gymnasium, CCT Campus, New Site Balzain, Tuguegarao City, Cagayan. The 4th Visayas S&T Cluster Fair followed from 22-26 October 2008 at the Island City Mall, Tagbilaran City, Bohol, while the 2008 DOST South Luzon S&T Fair was held from 11-14 November 2008 at the Olongapo Convention Center, Olongapo City. And finally, the SUBIC TECH: e-NNOVATING BUSINESS AND GOVERNANCE was held from 26-29 November 2008 at the Subic Bay Exhibition and Convention Center (SBECC), Subic Bay Freeport Zone, Zambales City.

The exhibitions featured numerous product displays and technology innovations of the different agencies of the Department. Among the technologies which the MIRDC featured were coco coir production using coco coir processing equipment such as husk beater, decorticator, carding, twining, slivering, baling, winnowing, rubber mixer, and mat roller press. The Center demonstrated the use of slivering machine which drew attention of the viewers. The technology is attractive to Filipinos since the regions are noted for coconut trees. Interestingly, it is hoped to become a big business opportunity in the coconut industry.

MIRDC joins S&T Cluster Fairs - from left: Ribbon cutting at Tuguegarao; demonstration on Coco Coir Technology at Tagbilaran City; viewing students strike a pose at S&T Fair in Olongapo City

Prospects Dim as Manufacturing Output Slows

Factory output, as measured by the volume of production index (VoPI), slowed to 2.2% in October, down 4.1 percentage points from 6.3% a month ago, the National Statistics Office (NSO) reported.

Former Budget Secretary and now University of the Philippines economist, Benjamin E. Diokno, described the VoPI's downward trajectory as unmistakable, adding that "Manufacturing has slowed down significantly and this is on top of the slowdown of major industries in 2007."

The NSO said nine major sectors posted negative performances: machinery except electrical (-46.1%), miscellaneous manufactures (-25.8%), textiles (-22.4%), transport equipment (-17.6%), paper and paper products (-17%), publishing and printing (-16.8%), furniture and fixtures (-15.8%), basic metals (-12%), and rubber and plastic products (-8.8%).

Three - machinery except electrical, miscellaneous manufactures, and transport equipment - account for the country's top exports.

"Obviously, the manufacturing sector is tracking the performance of the export industry. We had a good showing during the first three quarters but landed to a -14.9% in October. So it mirrors the potential effect on the [exports sector]," Philippine Exporters Confederation, Inc. president Sergio R. Ortiz-Luis said.

Mr. Diokno said that based on the NSO report, a number of industries appear to be in trouble: textiles, footwear and wearing apparel, chemical products (excluding plastics), cement, basic metals, iron and steel, nonferrous metals, machinery except electrical, electrical machinery, transport equipment, furniture and fixtures, and miscellaneous manufactures.

A slight increase in unemployment rate to 6.8% also affected the sector. Some 8.4% of the total number of employed is covered by the manufacturing sector.

"Given the broad spectrum of industries in distress and the depth of the slowdown for some, it could only mean higher unemployment in the sector. This is consistent with the significant loss of wage-and-salary jobs in 2008," Mr. Diokno said.

The NSO said double-digit growths posted by four major sectors offset the negative impact from the nine industries, enabling manufacturing as a whole to maintain a positive showing.

The gainers were makers of leather products, which accounted for the highest growth at 28.9% from 0.5% the previous month; fabricated metal products (18.3%); petroleum products (17.7%); and tobacco products (12.5%).

But Mr. Diokno is not all that optimistic that things will remain that way moving forward.

"The prospects for 2009 are dim. [And] if firm owners see the slowdown as prolonged, further layoffs are likely," he said.

Mr. Ortiz-Luis, meanwhile, said "If the crisis does not deepen further, we expect a recovery for export next year. A reversal may occur by the second quarter of next year, so the same will happen to the manufacturing sector."

On the same note, the value of production index grew at a slower 9.3% in October from 13.6% a month ago. But it was better than the 0.4% a year earlier.

The NSO said "nine major sectors accounted for the significant growth in production led by leather products (35.5%), fabricated metal products (30.4%) and petroleum products (29.5%)."

The value and volume of net sales were cut back to 3.8% and -3% from the previous month's 6.5% and 0.6%, respectively.

The proportion of factories that operated at full capacity for October stayed at 10.8%; 61.5% were at 70-89% capacity; while 27.7% operated below 70% capacity.

Source: BusinessWorld 12/24/2008

MIRDC Welcomes... from p1

(FNRI), Forest Products Research and Development Institute (FPRDI), Industrial Technology Development Institute (ITDI), Metals Industry Research and Development Center (MIRDC), Philippine Nuclear Research Institute (PNRI), Philippine Textile Research Institute (PTRI), Philippine Council for Aquatic and Marine Research and Development (PCAMRD), Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Philippine Council for Advanced Science and Technology Research and Development (PCASTRD), Philippine Council for Health Research and Development (PCHRD), and Philippine Council for Industry and Energy Research and Development (PCIERD). The participants learned the technologies generated by the DOST RDIs and projects funded by the Councils, thus providing them an easy approach in promoting and/or facilitating the adoption of technologies for commercialization. They also got exposure on the production facilities as well as acquire information on the services, program and projects of DOST RDIs and Councils.

New high frequency solid state generators

High frequency solid state generators are used for induction heat treatment processes such as hardening, brazing, soldering, melting, levitation melting, gluing and shrink fitting. The former high frequency solid state generator series for Linn High Therm have been replaced by new powerful device. The power ranges from 1,2 to 10 kW at 150 to 450 kHz working frequency is covered. The latest technology provides more flexible applications, less weight, smaller dimensions, lower price and high efficiency. Remote control via RS interface allows easy integration into existing production. The integrated control unit allows flexible heating programs with user defined power ramps. Induction coils with a wide inductivity range can be used.

Source: Metal Casting Technologies, vol. 54 no. 3 September 2008, p.102

Texpen writes on metal surfaces

Texpen steel-ball pens have the ability to write permanently on steel that is dirty, oily, greasy and rough. Texpens are designed to write on any solid surface, even underwater.

Available in green, blue, black, red, yellow and white, the specially designed ballpoint tip, only allows ink to flow when you want and will never dry out.

Ideal for stocktaking of steel, a different color permanent mark can be applied with each stock take thus allowing easy identification of slow moving material.

Source: Metal Casting Technologies, vol. 54 no. 3 September 2008, p.102

Texpen writes on metal surfaces

MIRDC Sets Intervention... from p1

1.3 Intensified Skills Training of Workers (e.g. welders, etc.)
1.4 Establishment of Regional Training Centers
1.5 Focused Intervention Towards Skills Qualification and Certification (TESDA National Certification)
1.6 Support to Professional Education (Cross-Training –MIRDC Industry Linkage; Cross-Training for Academe; On the Job Training; Open Lab)
1.7 Productivity and Quality Improvement Programs (Assistance to ISO 9001 Compliance of M&E firms)

2. Sustaining Support to Technology Acquisition & Upgrading Program
2.1 Firm-level Technology Upgrading (DOST Intervention Programs; Technology Transfer; Technical Consultancy)
2.2 Incentive for Technology Adoption/Modernization (Referral and Endorsement for Financing & Technical Assistance
2.3 Information Campaign on Must-be-Acquired Technologies (Promotion of Technologies; Database on Products, Process Technologies, Materials & Techno-Expert; Availability of e-copies on generated statistics/publications; Regular industry dialogues)

3. Promoting an R&D Culture in the Industry Program
3.1 Strengthen intra-and inter-sectoral linkage towards collaborative technological innovation (Localization of Parts and Components; Equipment Prototyping; Process Development)
3.2 Support Facilities on Product & Equipment Reliability Testing (LPG tanks, G.I sheets, Rebars, etc.)
3.3 Shop Accreditation
3.4 Priority Assistance Program (Technicom)
3.5 Information and Awareness Campaign (Study Tours; Expand Database on Ongoing Researches & New Technologies)

4. Supporting Sectoral Intervention Program
4.1 Creation of Regional Consortia
4.2 Representation in Relevant M&E associations
4.3 Host the M&E Associations (provide a space for M&E to locate at MIRDC; provide secretariat services)
4.4 Recognition Scheme for M&E Practitioners
4.5 Training Center for Servicing/Maintenance of CNC Machines
4.6 Co-management for the Metalworking Facilities of TESDA

The result of the consultative meeting was presented and discussed during the MIRDC Management strategic planning held early December this year.

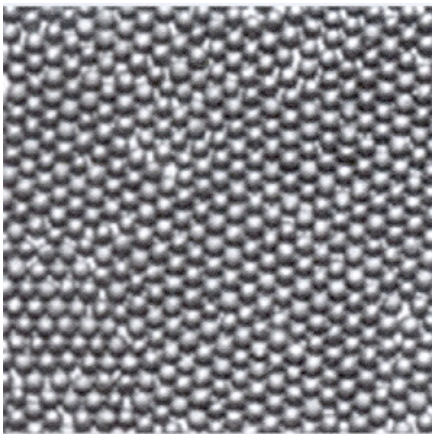
New stainless steel shot

Granowski has added a new stainless steel medium to the current range of abrasives, AMACAST-stainless steel shot. Exceeding the life of aluminum oxide, glass beads, mineral abrasives, garnet of slag by up to a thousand-to-one AMACAST can significantly reduce your raw material and disposal costs.

AMACAST is a cost effective stainless steel shot due to its hardness, longer life and performance. At a minimum density 7 g/cc, AMACAST is denser than any other stainless steel shot in the market, translating to delivery of more cleaning energy to the work surface. This results in improved rate of cleaning, thereby lowering production and blast time requirements.

AMACAST is designed to meet specific production requirements such as bright, metallic finish, free from staining and ferrous residue, or a specific surface profile to prepare for coating.

Source: Metal Casting Technologies, vol. 54 no. 3 September 2008, p.98



Capturing, documenting borescope inspection images of castings

Documenting borescopic inspection of cast parts and components is increasingly important with the growth of inspection policies. The new Luxxor Video System from Gradient Lens Corporation (GLC) offers manufacturers an easy way to capture, share and store borescope inspection images, aiding the effort to discover product flaws easily in the manufacturing process.

The Luxxor Video System connects to any rigid or flexible Hawkeye Precision Borescope, which GLC manufacturers, as well as to most other borescope brands. The benefits of using the Luxxor Video System include the ability to:

- easily document inspections and store video or still images on a computer hard drive
- share inspection images via e-mail or hard copy
- hold group reviews of inspection images displayed on a video monitor
- more easily and quickly conduct repetitive inspections by relieving the physical and mental fatigue of inspectors.

Source: Metal Casting Technologies, vol. 54 no. 3 September 2008, p.98

Auto saw for sectional and solid steels

Capable of operating in both automatic and semi-automatic modes, the Shark 410 CNC HS automatic band sawing machine cuts both sectional and solid structural stainless steels, and light alloys with up to 410 mm diameters and rectangular dimensions of 450 x 410 mm.

The machine's multi-processor allows 32 different lots in different lengths and quantities to be cut from the same bar, while a self-aligning vice can also feed deformed and mis-sharpen bars, with a minimal automatically feedable rest piece of 100 mm. Fed by a brushless motor and screw/nut system with recirculating balls-crews and 700 mm stepper motor, bars weighing up to 300 kgs are cut to a cast iron bow-head of rigid construction allowing greater cut control and a longer blade life.

Rotation of a bi-metal band (suitable for both sections and solids) by a vector-inverter motor means the cutting speed can be continuously adjusted from 15 m/min to 110 m/min. Comparative parameters for cutting load, cutting pressure, and cutting deflection are all programmed in 'real time' through a programming console. This console comprises a LCD screen to display cautionary and diagnostic messages in the language of use, and touch-tone polyester thermal shaped buttons.

Source: Metal Casting Technologies, v. 54 no. 3 September 2008, p.101

SME Tours at MIRDC

Headed by their chapter chair, Mr. Edison U. Ang, the Society of Manufacturing Engineers (SME) Manila Chapter 165 visited the facilities of MIRDC recently. The participants composed of members who are professional practitioners from various field of manufacturing and members of SME's affiliate student chapter.

The visit is aimed at getting familiar on the metal processes that the Center is employing which may help keep them abreast with the evolving needs of industry and global competition. Afterwards, the team also conducted plant tour to the Bureau of Product Standards (BPS) Testing Center located inside the MIRDC compound.

The Society of Manufacturing Engineers is the world's leading professional society advancing manufacturing knowledge and influencing more than half a million manufacturing practitioners annually. Headquartered in Michigan, the Society has members in more than 70 countries and represents manufacturing practitioners across all industries.

SME key officials hand over a certificate of appreciation to MIRDC for a worthwhile facility tour

"PS" Mark for Domestic Steel Angle Bar Industry

To safeguard and protect the local steel industry of angle bars and establish a common national standard, the locally produced angle bars which successfully passed the requirements of the Philippine National Standard (PNS) will be marked with a Philippine Standard or "PS" mark. On the other hand, imported angle bars will be marked with Imported Commodity Clearance or "ICC" mark.

This was resolved during the public consultation recently conducted by the Department of Trade Industry (DTI) to address the measures filed by the domestic steel angle bar players against importation of steel angle bars from different countries. This is in relation to the Implementing Rules and Regulations (IRR) of R.A. 8800 under Rule 5.2 which states, "the Secretary when establishing that the application of a safeguard measure will be in the public interest shall take into consideration the following factors, among others: (i) whether the imposition of the provisional measure will result in political and economic crisis, and (ii) the extent to which such imposition will cause a shortage of product under consideration in the domestic market."

The resolution shall be implemented to establish a quality standard in collaboration with the Association of Structural Engineers of the Philippines (the user), the Manufacturer of Angle Bar Industry (the manufacturer), and the Bureau of Product Standards (the standardizing body). Meanwhile, the Bureau of Trade Regulations and Consumers Protection (BTRCP) shall conduct a conformity assessment of angle bars in coordination with the Bureau of Product Standards (BPS) who established the development of product standard requirements. The MIRDC, being the lead testing agency, establishes the complete physical tests for angle bar products using the established requirements of PNS. This standard will deter the proliferation of substandard of the angle bar in the market. In addition, with the rising cost of steel materials, the need for an economical yet strong standard quality system is of paramount importance.

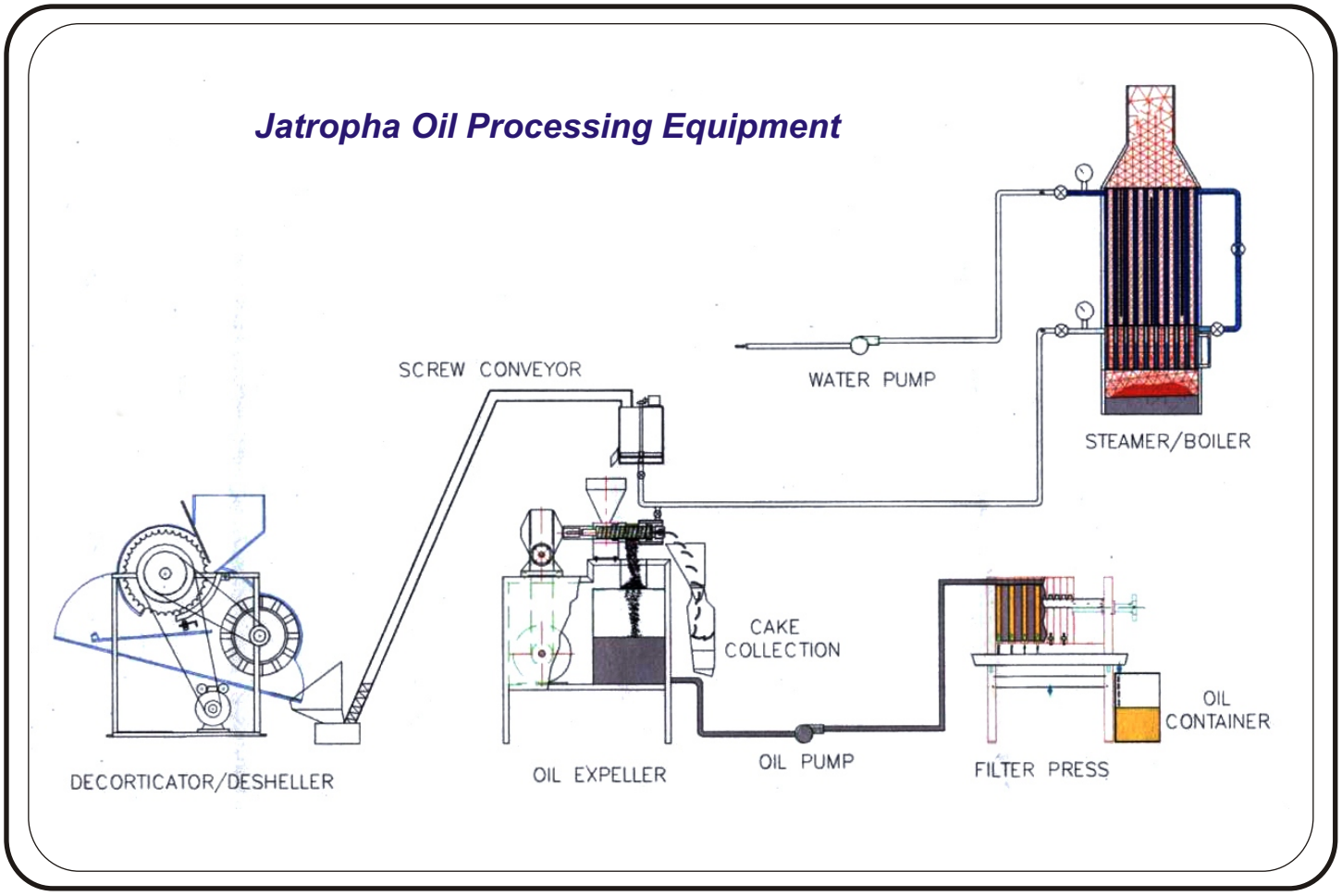
Development of a Prototype Equipment for Jatropha Oil Processing Technology, On Going

The Metals Industry Research and Development Center, in cooperation with the Industrial Technology and Development Institute (ITDI) and Philippine Council for Industry and Energy Research and Development (PCIERD), is developing a technology for Jatropha. The MIRDC is now developing the design of the equipment for extraction and dehulling processes of jatropha. The input material to the equipment is the jatropha seed and after passing through the four equipment, namely: steamer/boiler, decorticator/ desheller, oil expeller, and filter press, the yield is the crude oil which can now be utilized as fuel to a low speed diesel engine. The processing will start with deshelling or dehulling, then will proceed to screw pressing and finally filtering. The process flow is shown in the diagram below.

The sizes of the equipment are more compact and durable. The frames of the equipment are cast solid metal. It has a capacity of 100 kgs seed of jatropha that yields 30-40 liters of crude oil. The oil content, the methyl esther, is about 38%. As compared to other biofuels, Jatropha Methyl Esther is more flammable than Coconut Methyl Esther (coconut) and Palm Oil Methyl Esther (palm oil). However, the cake produced after processing at the oil expeller is toxic. This is why the crude oil out from jatropha is only dedicated for fuel and not as food stuff.

Jatropha curcas is found throughout the Philippines, in the Tagalog region, it is known as tubang-bakod; in Bicol, as tuba; in Visayas and Mindanao regions, as tuba-tuba. It is a drought - resistant perennial shrub or small tree that has an economic life of 35 to 50 years. The seeds of jatropha can usually be harvested one year after planting. Seeds for replanting can be gathered when the fruits are already yellow to dark brown.

The development of the equipment is now on its fabrication stage. Specifically, some of the pattern of the parts were already made and other parts were being drawn. The project runs from July 2007, and is set to be completed by the end of 2009. The project cost is PhP 1.5 M.



Prototype Development Cum Testing of Mercury Retort for the Philippine Small Scale Gold-Mining Industry

By:
Maria Gracia M. Peralta and Eduardo M. Deang, Jr.
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Department of Science and Technology

Continuation from previous issue

Another concern of the small-scale gold miners in Bicol is that the heating vessel is hard to handle when hot thus gold extraction process becomes difficult. It is understandable that artisanal miners are eager to see the gold they produced right after retorting. However, it is unsafe to open the vessel while it is still hot. If the retorting process is not complete, some mercury may still be in the vapor state and the fumes may be inhaled by the operator.

The last concern of the miners to make a smaller capacity vessel can easily be complied with.

Design of the Retort

Changes in the design of the existing retort was made based on the thorough review of the set of specification requirements of gold miners in Camarines Norte vis-a-vis the information from literature. The device will have the following features:

1. Concaved bottom of the heating vessel for a more efficient vaporization of mercury and better collection of processed gold.
2. Four different sizes of heating vessel to accommodate a wide range of retorting needs: 70 g, 105 g, and 130 g, 300 g amalgam capacity heating vessels.
3. Stainless steel material will be used for amalgam vessel, condenser tube, and other metal component of the retort.
4. Graphite gasket will be used to seal the amalgam vessel.
5. Viton rubber gasket will be used to seal the collecting vessel.
6. A simple steel ball relief valve will be incorporated on the collecting vessel to dissipate any pressure build up in the retort.
7. A simple paraffin wax vessel will be incorporated in the condenser tube to address the "black-box effect" of retorting.

In general, the entire unit described above will be made smaller than that of MIRDC's working model.

Test Procedure

The following test procedures will be followed to verify the effectiveness of the device:

Amalgamation:

1. Obtain gold powder from the gold nugget by filing.
2. Determine the weight of gold powder using Mettler balance.
3. Weigh approximately 5 grams of mercury per gram of gold powder in the Mettler balance. Use rubber gloves or latex gloves in handling mercury.
4. Mix the gold powder and mercury in a reagent bottle. Put a small amount of water to cover the mercury. Close the reagent bottle.
5. Agitate the reagent bottle until specks of gold are not anymore visible at the bottom of the reagent bottle.

Filtration:

1. Use rubber gloves or latex gloves in handling the amalgam and excess mercury.
2. Decant the water from the reagent bottle in a beaker.
3. Remove excess mercury by squeezing it through a damp chamois cloth until no more mercury passes through the cloth. The hard lump filtrate is the amalgam.
4. Weigh the amalgam in a Mettler balance.
5. Determine the weight of mercury in the amalgam by subtracting the weight of gold.

Retorting Process:

1. Ensure that the gaskets and safety valves are properly in place and the retort device is air tight.
2. Screw the collecting vessel tightly in the cooling jar head of the retort.
3. Fill the cooling jar with water. Close the cooling jar with the cooling jar head.
4. Secure the retort on a stand.
5. Put the amalgam in the amalgam vessel. Screw the amalgam vessel tightly on the evaporator head.
6. Slowly heat the amalgam vessel using Bunsen burner.
7. Secure data on the temperature of the curved portions of the condenser tube using digital thermocouple.
8. Observe the wax on the paraffin wax vessel.
9. Wait for the mercury to evaporate and condense on the condenser tube.
10. When the condensation of mercury stops, continue heating the vessel for at least 5 more minutes to be assured that the retorting operation is completed.
11. Put off the Bunsen burner.
12. Let the vessel cool to room temperature.
13. Remove the gold from the vessel.
14. Weigh the gold and the recovered mercury using Mettler balance.
15. Document the observation and test data.
16. Repeat the amalgamation, filtration, and retorting process three more times.

DISCUSSION OF RESULTS AND FINDINGS

Recovery of Mercury and Gold from Amalgam

Figure 1 is a graphical representation of the data tabulated in Table 1 of Annex A. It shows the weight of gold and mercury in the amalgam before the distillation process in the newly designed retort and the amount of gold and mercury after the distillation. The amount of gold powder used in the first trial is 0.3 gram and more or less 1 gram of gold for the next three trials. The amount of mercury that cleaved with the gold in the amalgam is proportional to the amount of gold powder. Based on the data, the amount of gold in the amalgam after manually squeezing the excess mercury in a chamois cloth, is around 25% on each of the four trials made.

The percent recovery for gold and mercury after distillation is shown graphically in Figure 2. It can be noted that the gold recovery on each of the trial is just below the targeted 100% recovery. This was expected prior to distillation process inasmuch as specks of iron fillings (from filing of the gold nugget) were observed on the chamois cloth after each filtration. The iron fillings were distinctly separated from the amalgam. In spite of this, the registered average gold recovery was still high at 99.14%.

The recovery of mercury was low at 92.09% on the first trial and gradually increases on the succeeding trials up to 99% on the fourth trial. It was observed that there were small spheroids of condensed mercury adhering on the condenser tube of the retort for each trial run. This confirms the information from literature that there will be apparent mercury losses for each distillation cycle mainly as a result of uncondensed fumes leaving the condensation system and mercury vapour that permeates into the refinery during retort loading/unloading processes. The apparent loss was expected to be high during the initial use of the retort.

The apparent losses, however, were higher with the experiment conducted as compared with the 0.2% - 0.4% stipulated in the literature. It is to be noted that the amount of amalgam used in the experiments were relatively small and any minute amount of mercury that did not reach the condenser vessel (i.e. stuck in the in the condenser tube) had affected the percent recovery due to the high density of mercury (13.6 gms/ cc.).

Additional experiment was conducted to validate the percent recovery of mercury in the developed retort. The objective of this additional experiment was to determine the recovery of mercury when the retort's evaporator vessel is loaded to its full rated capacity. Due to the limited amount of gold, pure mercury was used in the distillation process. Figure 3 shows the amount of mercury used prior to distillation and the weight of mercury recovered after the retorting process. The recovery was computed to be 99.72%.

The Black-Box Effect

The black-box effect is a term coined by Veiga to illustrate the difficulty experienced by small-scale gold miners in using mercury retort. When using mercury retort made from steel material, the miners cannot observe the whole process of distilla-

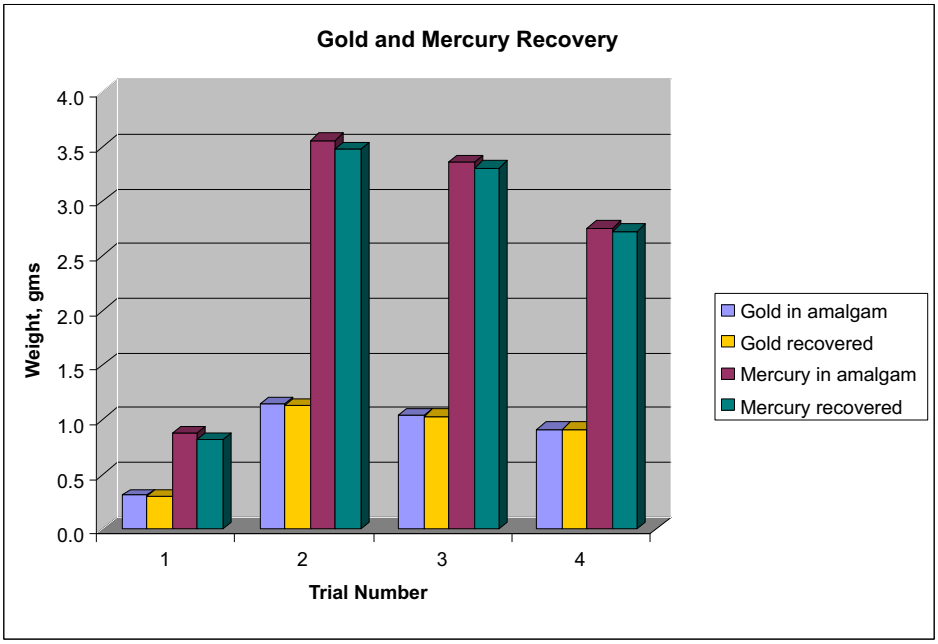

Figure 1. Weight of gold and mercury before and after distillation process

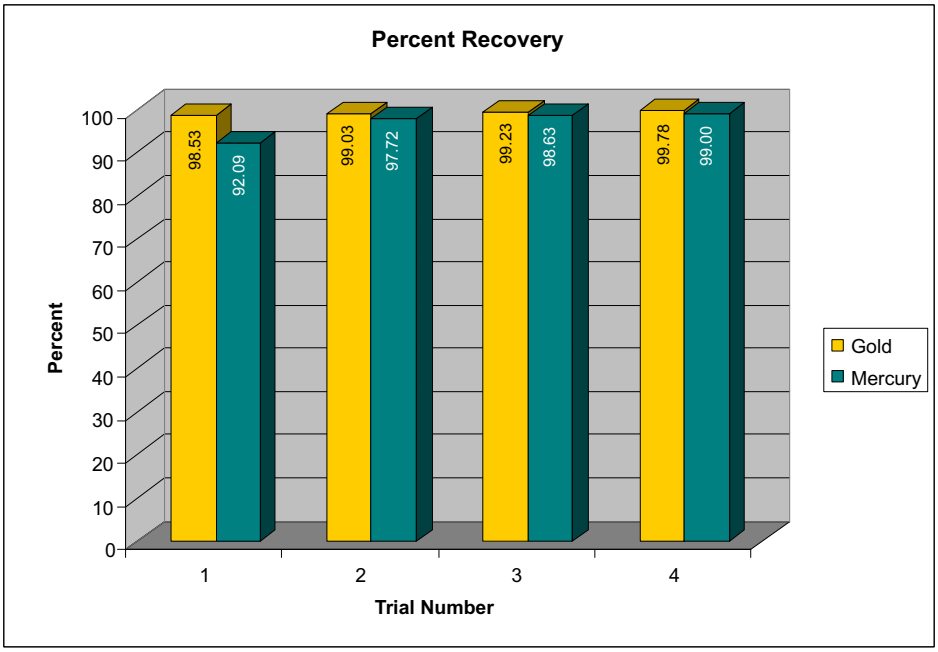

Figure 2. Percent recovery of gold and mercury from amalgam

tion. Thus, they prefer open burning of the amalgam in a shallow clay pot. To encourage the artisanal miners to use the retort, MIRDC desires to devise a method of identifying the start and completion of the distillation process.

Initially, a small wax vessel was incorporated in the condenser tube. This wax vessel was filled with candle wax. Candle wax was chosen because it is readily available in the mining site. The wax vessel was strategically located such that the temperature of the condenser tube during retorting will be between 40°C to below 60°C. This was obtained to be about 5 mm. below the tube bend near the condenser head during the testing conducted on the former MIRDC retort.

However, during the experimentation, it was found out that the wax vessel was not effective in addressing the black-box effect of retorting. During cooler days and with small amount of amalgam, the temperature of the condenser tube at the location of wax vessel did not reached the melting point of the wax (i.e. 49°C) and therefore, there was no change in the physical state of the wax in the vessel. But when the retort was used to its full rated capacity, the wax reached its boiling point (i.e. 71°C), and the whole content of the wax vessel spilled over into the condenser head.

Nevertheless, a practical method of identifying the start and end of distillation was observed during the conduct of the experiment and the subsequent analysis of the temperature gradient of the condenser tube.

The heating curve of the condenser tube of the retort is shown on Figure 4 for the distillation of mercury from amalgam (3 curves) and pure mercury (1 curve). The amount of mercury for each experiment is indicated on the legend. On the first trial (amalgam, 0.8829 gms. Hg), the temperatures on the first and second bend of the condenser tube were obtained by moving the thermocouple from one bend to the other during the first 10 minutes of retorting. This was not done on the remaining three curves; the temperatures were taken only at the bend portion near the evaporator head (first bend). It can be observed, that the curve of the first trial was different from the curves of the remaining three trials for the first ten minutes. The reason behind this is the hysteresis of the measuring instrument, or the delay on the response of the thermocouple on the actual temperature of the condenser tube. It is probable that the thermocouple had not yet stabilized during the reading of the temperature.

For the other three trials, the curves show a slow descent of temperature for the first three minutes of retorting process. An abrupt increase in temperature was observed in the fourth minute. The peak temperatures were maintained on the fifth minute for trials with 3.5574 gms Hg and 3.560 gms Hg before a marked decrease in temperatures were noted. For pure mercury, the peak temperature was maintained up to the thirteenth minute. The temperature descent markedly right after the termination of the plateau which can be construed as an indication that the evaporation of mercury vapor had already ceased.

It is interesting to note that the temperatures dropped continuously for the succeeding nine minutes right after the plateau on all curves before the temperatures increase again slowly.

The first drop of mercury in the condenser vessel on the two trials with

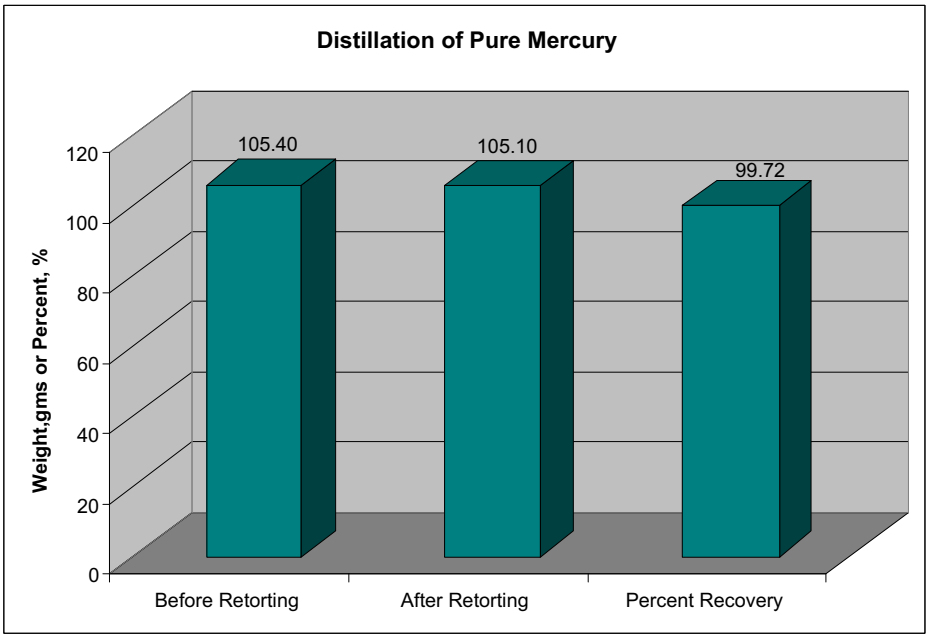

Figure 3. Trial run on the retorting of pure mercury at the rated full capacity of the evaporator vessel

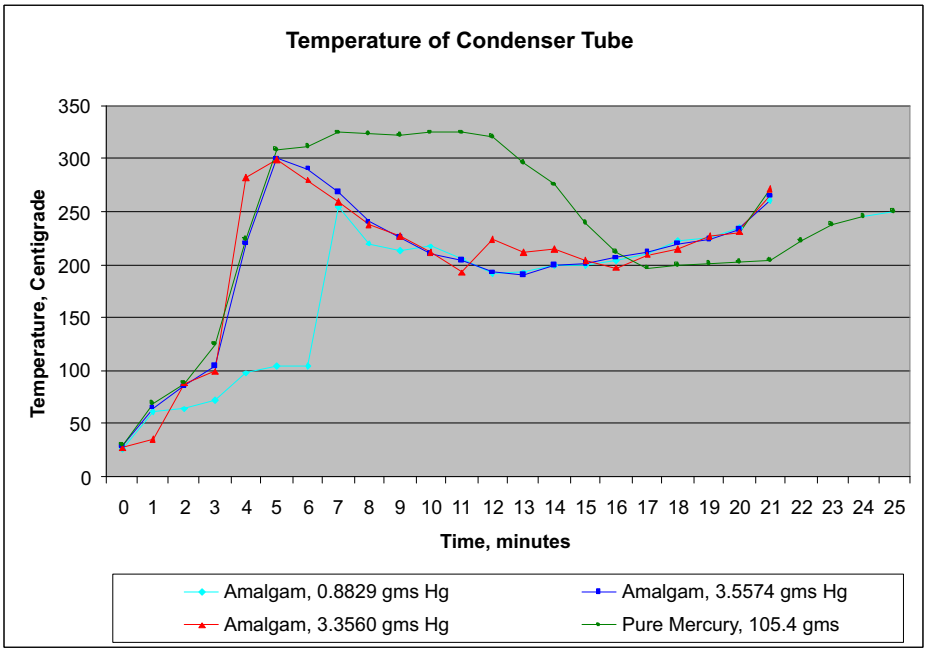

Figure 4. Temperature gradient on the condenser tube during retorting process

amalgam was observed two minutes after the start of heating and the amount of condensing mercury peaked on the fifth minute. For the pure mercury, these occurrences were observed on the fourth minute and fourteenth minute, respectively.

On all trials, the stainless color of the evaporator vessel was maintained up to the peak temperature. The color changes to brown red on the first minute that the temperature decreases after the plateau. This is another indication that all mercury has already evaporated and the heat from the flame is being absorbed by the evaporator vessel. The color of the vessel becomes fully cherry red on the seventh minute after it became brown red.

The stainless color of the vessel was restored after cooling the retort to room temperature. The gold was not discolored by the retorting process in the stainless steel evaporator vessel.

SUMMARY AND CONCLUSION

The modified mercury retort retained most of the attributes of the MIRDC retort. The evaporator vessel was made smaller with a concaved bottom and the wall thickness was reduced to 2 mm.

Glass evaporator vessel was not considered due to the articles published by Mr. Marcelo M. Veiga, Chief Technical Advisor of UNIDO on artisanal gold mining, and Dr. A.K. Williams.

For safety purposes, a fixture was not incorporated on the evaporator vessel to discourage the miners from opening the vessel while it is hot since there might still be uncondensed toxic mercury fumes in the vessel.

The warming up of the stainless evaporator vessel was only four minutes which is faster than the minimum warming up time of Therm-Ex glass retort.

The maximum recorded gold and mercury recovery from the amalgam were 99.78% and 99%, respectively. On the distillation of pure mercury at the full rated capacity of the retort, the mercury recovery was computed at 99.72%.

The "black-box effect" on retorting was addressed methodically. Practical approach will be to observe the change of color of the evaporator vessel from stainless to brown red and then maintaining the flame for another 10 minutes to ensure that all mercury had evaporated and separated from the amalgam.

The color of gold was not discolored by the distillation process using the modified retort.

RECOMMENDATION FOR FUTURE R&D WORK

It is recommended that the acceptability of the modified retort be verified through field testing in Bicol as well as on other provinces that has small-scale gold mining activities.

Furthermore, R&D projects should be conducted to improve the gold panning process and amalgamation process of the artisanal gold miners.

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