

Optimization and Performance Testing of a Hydraulic Coconut Milk Extraction Machine

Raymart Añar, Jeonelle Mingi, Marjun Caguay*, Carl Mudat, July Kit Lacsina

(Institute of Agricultural and Biosystems Engineering, Mindoro State University, Alcate, Victoria, Oriental Mindoro, 5205, Philippines)

Abstract: The study aimed to design, fabricate, and evaluate a hydraulically powered coconut milk extraction machine to address challenges related to labor intensity, efficiency, and cost-effectiveness in small-scale coconut processing. The machine was developed using locally available materials and technology, focusing on enhancing extraction efficiency, recovery, and capacity while ensuring accessibility for a broader user base, including women and people with disabilities. The research involved a completely randomized design (CRD) with five different pressure settings (1300 to 1700 psi) to assess the machine's performance. The evaluation parameters included extraction efficiency, recovery, and capacity. Results indicated that the machine achieved peak extraction efficiency of 92.51% and a maximum extraction capacity of 50.98 kg hr⁻¹ at 1600 psi. However, higher pressures did not significantly impact extraction efficiency and recovery, suggesting that while pressure plays a role, its effect is limited within the tested range. The machine outperformed traditional hydraulic jack-type and screw-type extractors in terms of efficiency, recovery, and capacity. Financial analysis showed that the machine has a low operating cost of Php 144,183.60 per year, with an annual revenue of Php 403,930.80, resulting in a net income of Php 259,747.20. The break-even point was calculated at 15,435.26 kg of grated coconut meat, with a payback period of approximately 0.35 years and a high rate of return of 180%. The results demonstrate that the hydraulic-powered coconut milk extractor is a cost-effective and efficient solution for small-scale coconut processing, offering substantial improvements over existing methods and contributing to the profitability and sustainability of coconut-based enterprises.

Keywords: Hydraulic extractor, Coconut milk, Small-scale processing, Efficiency, Cost-effectiveness, Performance, Financial analysis

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1 Introduction

Coconut milk is a versatile and widely consumed product, commonly used as a food ingredient in a variety of culinary applications, including curries, desserts, bakery items, and even in virgin coconut oil production (Coconut Development Board - Ministry of Agriculture & Farmers Welfare, Govt. of India,

2023). The extraction of coconut milk from mature coconut meat has traditionally been achieved through manual methods or mechanical extraction machines. However, despite the availability of different extraction techniques, significant challenges remain for small-scale producers, particularly in terms of efficiency, cost, hygiene, and labor requirements.

Manual extraction, often involving squeezing the coconut meat by hand or using cloths, is labor-intensive and susceptible to hygiene concerns, with potential contamination from bacteria affecting the quality and shelf life of the coconut milk (Hamilton

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***Corresponding author: Marjun Caguay.** Faculty, Institute of Agricultural and Biosystems Engineering, Mindoro State University. Email: jupitermercurio28@gmail.com.

and Munsang, 2008). Conversely, benchmarking activities revealed that a mechanical extraction machines, such as screw-type or hydraulic jack extractors, have become more common in regions like Oriental Mindoro. However, these machines also have limitations. Screw-type machines, often imported, are expensive and difficult to maintain, particularly when spare parts are required. Hydraulic jack and manually operated machines, while more affordable, require significant physical effort and are inefficient for large-scale production, limiting their usability to certain demographics and small-scale businesses.

Given these challenges, the present study was conducted to address the need for an affordable, efficient, and gender-inclusive coconut milk extraction solution. The research focused on designing, fabricating, and evaluating the performance of a hydraulically powered coconut milk extractor. By utilizing locally available materials and technology, this machine aimed to improve the extraction process while being accessible to a wider range of users, including women and people with disabilities. The machine's design sought to alleviate labor demands, enhance sanitation, and increase the production capacity, thereby providing a practical solution for small- and medium-sized enterprises (MSMEs) and coconut processing cooperatives.

The objectives of this study included designing and fabricating the hydraulic-powered coconut milk extractor, evaluating its performance in terms of extraction capacity, efficiency, and recovery, and conducting a cost analysis to assess the feasibility and affordability of the machine. By addressing the limitations of existing extraction methods, this research contributes to improving the livelihood of coconut farmers and small business owners, offering a sustainable and practical solution to the challenges faced by the coconut milk extraction industry.

2 Materials and methods

2.1 Design and development of the machine

The machine's design was conceptualized based

on benchmarking activities conducted with local coconut processors in the area. The hydraulic coconut milk extraction machine operates with minimal manual intervention and is more efficient than traditional manual methods. It ensures consistent pressure, higher extraction efficiency, and better product hygiene, addressing the limitations of manual and screw-type extractors. Figure 1 shows the design of the hydraulic coconut milk extraction machine. It comprises three major components: the hydraulic system, pressing chamber unit, and the frame assembly.

2.1.1 Frame assembly

The frame assembly serves as the structural support for the machine, designed to withstand forces exerted during the extraction process. To ensure the structural integrity and safety of the frame, engineering calculations were conducted using standard mechanical design principles (Engineers Edge, 2000).

The frame assembly provides the structural support necessary to maintain the stability of the machine during operation. It was designed to withstand the forces exerted by the hydraulic system while ensuring durability and minimal deflection. For the construction, mild steel (A36) was selected due to its widespread availability, ease of fabrication, and sufficient mechanical properties suitable for agricultural applications. The yield strength of mild steel was assumed to be 250 MPa, and a factor of safety (FOS) of 2.5 was applied to account for uncertainties in loading conditions and ensure safe performance over time. Based on these parameters, the allowable stress used for the design was calculated to be 100 MPa.

The hydraulic system's maximum applied pressure was estimated at approximately 1700 psi (equivalent to about 11.72 MPa). Using this pressure and the cross-sectional area of the piston, the total force exerted during operation was estimated at around 10,000 N. This value was used to compute the maximum bending moment, from which the section modulus of the supporting I-beam was determined.

Subsequently, the required flange and web thicknesses were calculated to withstand the axial and shear stresses generated during pressing operations. These calculations guided the selection of standard steel sections that meet strength requirements while being practical for fabrication.

The resulting frame structure effectively supports the pressing unit, hydraulic components, and loading forces during operation. It ensures mechanical stability, minimizes deflection, and enables safe, efficient coconut milk extraction under repeated use.

The calculation of allowable stress is done using Equation 1.

$$\sigma_{Allow} = \frac{YS}{FOS} \quad (1)$$

Where, σ_{Allow} is the allowable stress (MPa), YS is the yield strength (MPa), and FOS is the factor of safety.

For the calculation of the section modulus, Equation 2 was used:

$$Z = \frac{M_{max}}{\sigma_{Allow}} \quad (2)$$

Where, M_{max} is the maximum bending moment (N mm) and Z is the section modulus of the I-beam (mm^3).

Equations 3 and 4 were used for the calculation of flange and web thickness, respectively.

$$t_f = \frac{F}{b_f \times \sigma_{Allow}} \quad (3)$$

Where, t_f is the flange thickness (mm), F is the force or load applied (N), and b_f is the flange width (mm).

$$t_w = \frac{v}{h \times \tau_{Allow}} \quad (4)$$

Where, t_w is the web thickness (mm), h is the web height (mm), and τ_{Allow} is the allowable shear stress for the material (N mm^{-2}).

2.1.2 Hydraulic system

In designing the hydraulic system, operational safety was a priority. Safety features considered included pressure and temperature ratings, interlock for sequential operation, emergency shutdown features, power failure locks, operational speed, and

environmental conditions. The system was designed to meet the following functional requirements: required performance specifications, life expectancy comparable to the machine, facilitation of good maintenance practices, compatibility with electrical and mechanical components, and resilience to operational hazards (Kannan, 2010).

2.1.2.1 Selection of hydraulic cylinder

The selection of the hydraulic cylinder was based on the required load capacity and working pressure. Since the load to be pressed was approximately 1000 kg (or 9810 N), and the selected working pressure ranged from 50 to 80 bar (5 to 8 MPa), the piston area (A) was calculated using Equation 5.

$$A = F / P \quad (5)$$

Where, A is the area of cylinder (mm^2), F is the load (N), and P is the working pressure (MPa).

2.1.2.2 Pump capacity

The pump capacity was calculated based on the stroke length of the cylinder and the desired stroke time. Using Equation 6:

$$Q = A \times S/t \quad (6)$$

Where, Q is the flowrate ($\text{m}^3 \text{s}^{-1}$), S is the length of stroke (m), and t is the time (s).

2.1.2.3 Electric motor

The power requirement of the electric motor driving the hydraulic pump was calculated using Equation 7, yielding a value of 0.35 kW. However, to accommodate startup loads and potential power fluctuations, a 0.55 kW electric motor was selected. This ensures reliable operation, improved efficiency, and the ability to handle prolonged use without overheating or loss of torque.

$$\text{kW} = (Q \times P)/600 \quad (7)$$

Where, Q is the flowrate (L min^{-1}), and P is the pressure (MPa).

2.2 Research design

For the performance evaluation of the machine, a Completely Randomized Design (CRD) was implemented, involving five treatments: T1 = 1300 psi (8.96 MPa), T2 = 1400 psi (9.65 MPa), T3 = 1500 psi (10.34 MPa), T4 = 1600 psi (11.03 MPa), and T5 = 1700 psi (11.72 MPa). Based on the findings of Tan

and Namoco (2012), coconut milk extraction was found to be optimal at 1500 psi with a pressing cycle of 12 and 5 kg of coconut meat. Therefore, the researchers selected 1500 psi as the standard pressure level to assess the machine's efficiency. Each test was conducted with three replications, and the sequence of tests was randomized.

The Statistical Tool for Agricultural Research

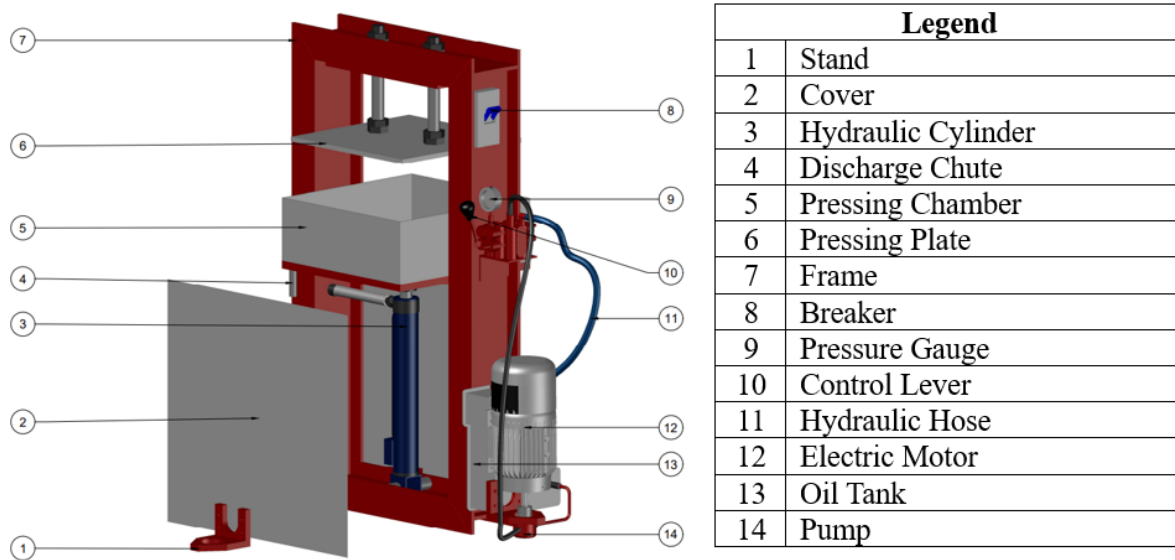


Figure 1 Perspective view of the hydraulic coconut milk extraction machine

2.3 Performance parameters

To achieve the study's objective, the extraction efficiency, extraction capacity, and extraction recovery were evaluated. The following equations, based on PAES 234 (2008) and PAES 235 (2008), were used to assess these parameters:

2.2.1 Extraction efficiency

Extraction efficiency is the ratio between the total moisture extracted by the machine to the total initial moisture content of the crop.

$$E_{ff} = \frac{W_{TJ}}{P_{JC}} \times 100 \tag{8}$$

Where, E_{ff} is the extraction efficiency (%), W_{TJ} is the total weight of extracted juice (kg), and P_{JC} is the potential juice content (kg).

2.2.2 Potential juice content (P_{JC})

The potential juice content (P_{JC}) refers to the theoretical amount of extractable liquid—typically coconut milk in this context that can be obtained from a given weight of grated coconut meat. It is derived from the moisture content of the raw material and is

(STAR) was employed to analyze the effects of the five pressure treatments on extraction efficiency, capacity, and recovery. Analysis of Variance (ANOVA) was used to assess the variability in machine performance across treatments, and the means were compared using the least significant difference (LSD) test at a 5% significance level.

essential for evaluating extraction efficiency, as it sets the benchmark against which actual extracted juice is compared.

$$P_{JC} = \left(\frac{MC_i}{100}\right) \times W_i \tag{9}$$

Where, P_{JC} is the potential juice content (kg), MC_i is the initial moisture content of the crop (%), and W_i is the weight of input material (kg).

2.2.2 Extraction recovery

The Extraction recovery is defined as the percentage of the total potential juice content that is successfully recovered during the extraction process. It serves as an important indicator of how effectively the system minimizes losses and converts the available juice into usable product. During extraction, some losses are inevitable—these may include juice retained in the residual coconut cake, spillage, leakage, or incomplete extraction due to limitations in machine pressure or performance. To determine extraction recovery, the extraction losses (denoted as E_L) must first be computed. Extraction losses are

calculated as the percentage of juice that was not extracted relative to the potential juice content (P_{JC}), which represents the theoretical maximum juice obtainable based on the initial moisture content of the coconut meat. Once the losses are identified, extraction recovery (R_e) is calculated using the equation 9:

$$R_e = 100 - E_L \quad (10)$$

Where, R_e is the extraction recovery (%), and E_L is the extraction losses (%).

2.2.3 Extraction capacity

Extraction capacity is defined as the quantity of juice or extract that a machine can produce per unit of time under normal operating conditions. This parameter is used to evaluate the machine's productivity and suitability for processing operations at a given scale. It reflects the operational throughput of the equipment and is influenced by factors such as the feed rate, pressure applied, mechanical design, and the efficiency of the extraction mechanism. Extraction capacity is typically expressed in kilograms per hour (kg h^{-1}) and is computed by dividing the weight of juice collected (W_f) by the total operating time (T_t). The formula used is:

$$E_r = \frac{W_f}{T_t} \quad (11)$$

Where, E_r is the extraction rate (kg h^{-1}), W_f is the weight of juice collected (kg), and T_t is the total operating time (h).

To complement the mass-based evaluation of coconut milk extracted, the corresponding volume was also determined using the average density of fresh coconut milk, which is approximately 0.924 g mL^{-1} or 924 kg m^{-3} (Charrondiere et al., 2012). This density value allows for the practical conversion of the extracted juice from kilograms to liters, which is more commonly used by processors and end-users in small-scale and commercial applications. The volume (V) of the extracted coconut milk was calculated using the following formula:

$$V = \frac{W}{\rho} \quad (12)$$

Where V is the volume in liters (L), W is the weight of extracted coconut milk in kilograms (kg), and ρ is the density of coconut milk, which is 0.924 kg L^{-1} .

2.4 Cost analysis

A thorough cost analysis ensures that the machine is a practical and beneficial investment for small-scale producers, balancing both financial and operational aspects to support the broader goals of efficiency and sustainability in coconut processing. For the calculation of the simple cost analysis of the hydraulic coconut milk extraction machine, the following equations were used (Hunt, 2001; Caguay, 2023):

2.4.1 Annual fixed cost

$$AFC = D + I + TIS \quad (13)$$

Where, AFC is the annual fixed cost (Php yr^{-1}), D is the depreciation cost (Php yr^{-1}), I is the interest on investment (Php yr^{-1}), and TIS is the taxes, insurance and shelter (Php yr^{-1}).

2.4.2 Annual variable cost

$$AVC = FC + R\&M + LC + LaC \quad (14)$$

Where, AVC is annual variable cost (Php yr^{-1}), FC is the electrical cost (Php yr^{-1}), $R\&M$ is the repair and maintenance cost (Php yr^{-1}), LC is the lubrication cost (Php yr^{-1}), and LaC is the labor cost (Php yr^{-1}).

2.4.3 Break-even point

$$BEW = AFC / (CR - VC/C) \quad (15)$$

Where, BEW is the break-even point (Kg yr^{-1}), AFC is the annual fixed cost (Php yr^{-1}), C is the extracting capacity (kg hr^{-1}), VC is the variable cost (Php hr^{-1}), and CR is the custom rate (Php kg^{-1}).

2.4.4 Payback period

$$Pp = (IC - SV) / AANi \quad (16)$$

Where, Pp is the payback period (yr), IC is the initial cost (Php), SV is the salvage value (Php), and $AANi$ is the added annual net income (Php).

2.4.5 Rate of return

$$ROR = AANi / AOC \times 100 \quad (17)$$

Where, ROR is the rate of return (%), $AANi$ is the added annual net income (Php), and AOC is the annual operating cost (Php).

3 Results and discussion

3.1 Description of the hydraulic coconut milk extraction machine

The fabricated machine operated using a batch process. Five kilograms of grated coconut meat were placed onto the pressing plate and compressed until no additional coconut milk could be extracted. The

machine employed a piston press-type extraction mechanism, which extracted the coconut milk by squeezing or compressing the grated coconut meat between two surfaces. Figure 2 illustrates the fabricated hydraulically-powered coconut milk extractor and its major components, while the machine's specifications are provided in Table 1.

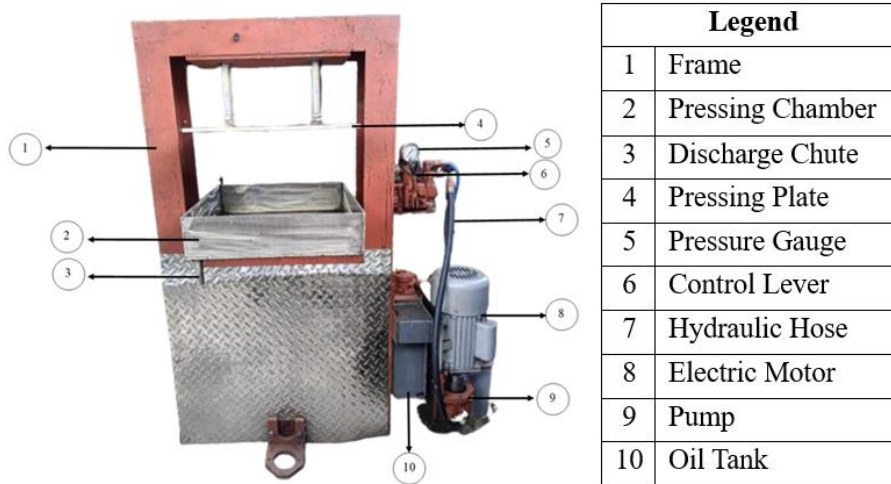


Figure 2 Fabricated hydraulic coconut milk extraction machine

Table 1 Specifications of the hydraulic coconut milk extraction machine

Components	Specifications
Machine overall dimensions and weight	
Length, mm	820
Width, mm	570
Height, mm	1520
Weight, kg	200
Frame assembly	
Length, mm	820
Width, mm	210
Height, mm	1520
Prime mover	
Type	Single phase induction motor
Rated speed, rpm	1720
Hydraulic tank	
Height, mm	370
Width, mm	130
Hydraulic hose	
Oil no.	#68
Pressure rating, psi	3990
Hose standard	SAE100R2AT
Pressing chamber	
SAE 304 stainless steel	
Length, mm	560
Width, mm	560
Height, mm	130
Slope, deg	5
Thickness, mm	12.7
Pressing plate	
SAE 304 stainless steel	
Length, mm	510
Width, mm	510
Thickness, mm	12.7
Machine performance parameters	
Extraction capacity, kg hr ⁻¹	41.75
Extraction efficiency, %	91.59
Extraction recovery, %	66.19

3.2 Performance parameters of the hydraulic coconut milk extraction machine

3.2.1 Extraction efficiency

Extraction efficiency refers to the machine's ability to extract coconut milk from grated coconut meat, expressed as a percentage (%). Figure 3 presents a graph illustrating the machine's extraction efficiency at different pressure levels.

The data shows a slight increase in extraction efficiency with rising pressure. At 1700 psi (11.72 MPa), the machine achieved the highest efficiency, with an average of 92.51% across three replicates. In contrast, 1300 psi (8.96 MPa) yielded the lowest efficiency, averaging 90.09% over the same replicates.

These findings align with the study by Mohd-Setapar et al. (2014) on rubber seed oil extraction,

where varying pressures (20 MPa, 25 MPa, and 30 MPa, equivalent to 2900 psi, 3625 psi, and 4351 psi, respectively) were used. Their results indicated that using supercritical carbon dioxide, the highest oil yield (33.562% g oil/sample) was obtained at 30 MPa and 60°C. Their study also noted that increasing pressure typically improves extraction yield.

However, it is important to highlight that the differences in extraction efficiency across the pressure treatments were minimal. For instance, the difference between 1300 psi (8.96 MPa) and 1700 psi (11.72 MPa) was only 2.42%.

Overall, the results suggest that within the pressure range tested, pressure level has a limited impact on extraction efficiency.

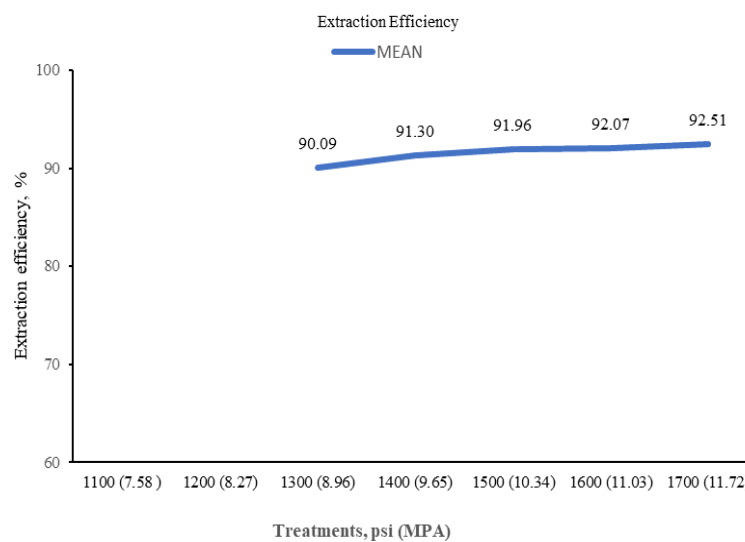


Figure 3 Mean extraction efficiency of hydraulic coconut milk extraction machine

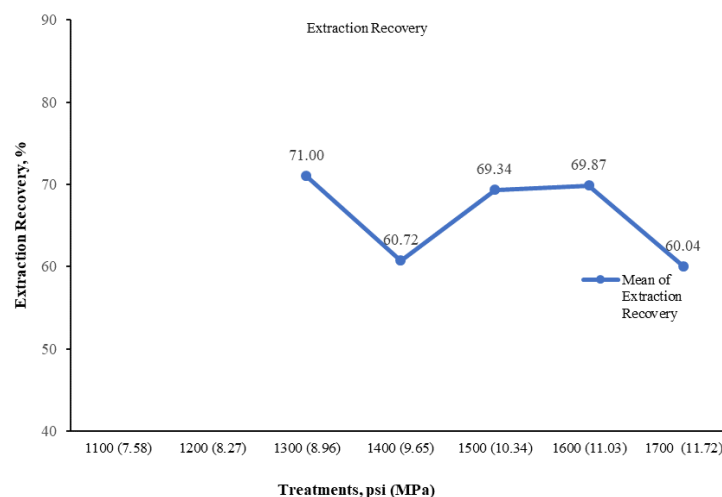


Figure 4 Mean extraction recovery of hydraulic coconut milk extraction machine

3.2.2 Extraction recovery

Figure 4 shows the mean extraction recovery (%) at different pressure levels. While the highest recovery was observed at 1200 psi (71.00%) and the lowest at 1700 psi (60.04%), the differences were not statistically significant ($p > 0.05$). This suggests that pressure, within the tested range, did not have a significant effect on extraction recovery.

The lack of a clear trend may be attributed to how juice interacts with the fibrous matrix of grated coconut under varying compression forces. At moderate pressures, juice may be more effectively expressed with minimal losses. However, at higher pressures, while more juice may initially be released (increasing extraction efficiency), a portion may also be absorbed back into the compacted fibers or lost through mechanical pathways, thus reducing recovery. These results imply that optimal pressure must balance mechanical extraction with minimizing losses to achieve the best overall performance.

3.2.3 Extraction capacity

Extraction capacity refers to the amount of material extracted per unit of time, measured in kilograms per hour (kg hr^{-1}). Figure 5 presents the extraction capacity of the machine for each replicate across the different pressure settings.

The figure indicates a trend of increasing extraction capacity with higher pressure levels, up to a certain point. The highest average extraction

capacity was recorded at 1600 psi (11.03 MPa), with a mean extraction rate of 50.98 kg hr^{-1} . Notably, there was variability in the extraction rates between replicates at each pressure level. For instance, at 1300 psi (8.96 MPa), extraction rates ranged from 25.82 kg hr^{-1} to 52.15 kg hr^{-1} , reflecting the influence of experimental conditions on the results.

The findings are supported by a study conducted by Bunthan et al. (2023), which explored the effects of different pressures—30, 40, and 50 MPa (4351 psi, 5801 psi, and 7251 psi)—and pressing times (ranging from 15 to 60 minutes) on the yield of extracted soybean oil. Their results demonstrated that the highest yield (12.49%) occurred at 50 MPa and a pressing time of 60 minutes. This suggests a direct relationship between the applied pressure and the extraction yield, similar to the pattern observed in this study.

However, the extraction capacity is also affected by the duration of the extraction process. A negative correlation exists between extraction time and capacity. As the extraction duration increases, the extraction capacity decreases. This suggests that while pressure plays a critical role in determining extraction rates, prolonged extraction times can reduce the overall capacity of the machine. Therefore, optimizing both pressure and extraction time is essential for maximizing efficiency.

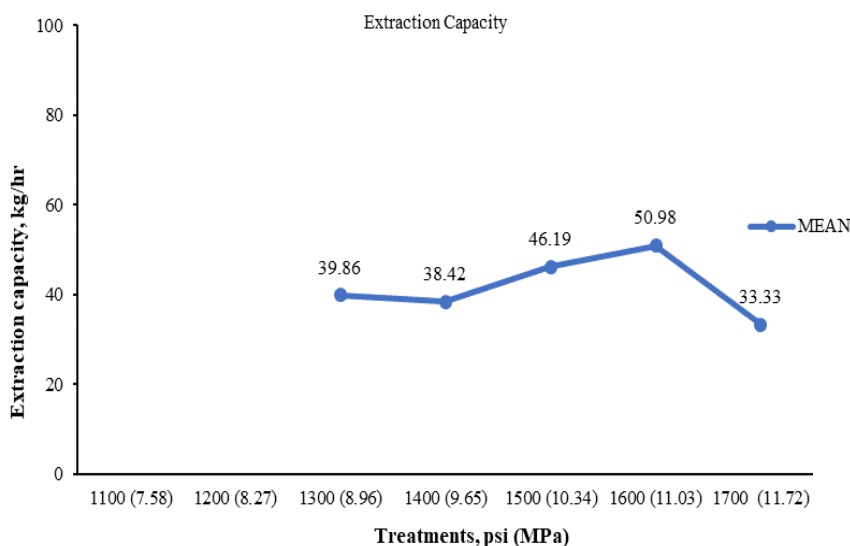


Figure 5 Mean extraction capacity of hydraulic coconut milk extraction machine

3.2.4 Comparison of the hydraulic coconut milk extractor to the existing machines

The statistical analysis of extraction efficiency, extraction recovery, and extraction capacity revealed no significant differences between the treatments. This suggests that the variations in pressure levels caused minimal differences in performance.

Moreover, research by Sena-Moreno et al. (2015) indicates that small differences in extraction methods, such as using a hydraulic press versus other systems, may not significantly impact certain parameters, such as total polyphenol content. This finding underscores that while pressure plays a role, a specific pressure level like 1700 psi may not be a decisive factor in determining extraction efficiency when considering the broader context of the extraction process.

The researchers also compared the performance of three different types of extractors: the hydraulic jack type extractor, the screw type extractor, and the hydraulic-powered coconut milk extractor. The performance of the hydraulic jack type extractor was based on actual tests conducted by the researchers, while the screw type extractor's performance values were derived from a study by Mohan and Anand (2019).

Figure 6 illustrates the differences in extraction efficiency between the three machines, showing that the hydraulic-powered coconut milk extractor outperformed both the manual hydraulic jack and screw type extractors in terms of extraction efficiency.

Similarly, Figure 7 highlights that the hydraulic-powered extractor achieved higher extraction recovery than the other two machines.

In terms of extraction capacity, the hydraulic-powered extractor also demonstrated superior performance compared to the manual hydraulic jack and screw type extractors.

Overall, the results of the comparison showed that the hydraulic-powered coconut milk extractor delivered more favorable outcomes than the hydraulic jack type extractor available on the market. Tests conducted with the same amount of grated coconut meat revealed that the hydraulic-powered extractor achieved peak extraction efficiency, recovery, and capacity values of 92.51%, 71%, and 50.98 kg hr⁻¹, respectively. These values are higher than those of the hydraulic jack type extractor, which had peak values of 85.24%, 52.73%, and 13.6 kg hr⁻¹, and the screw type extractor, which had peak values of 78.27%, 49.03%, and 36.36 kg hr⁻¹.

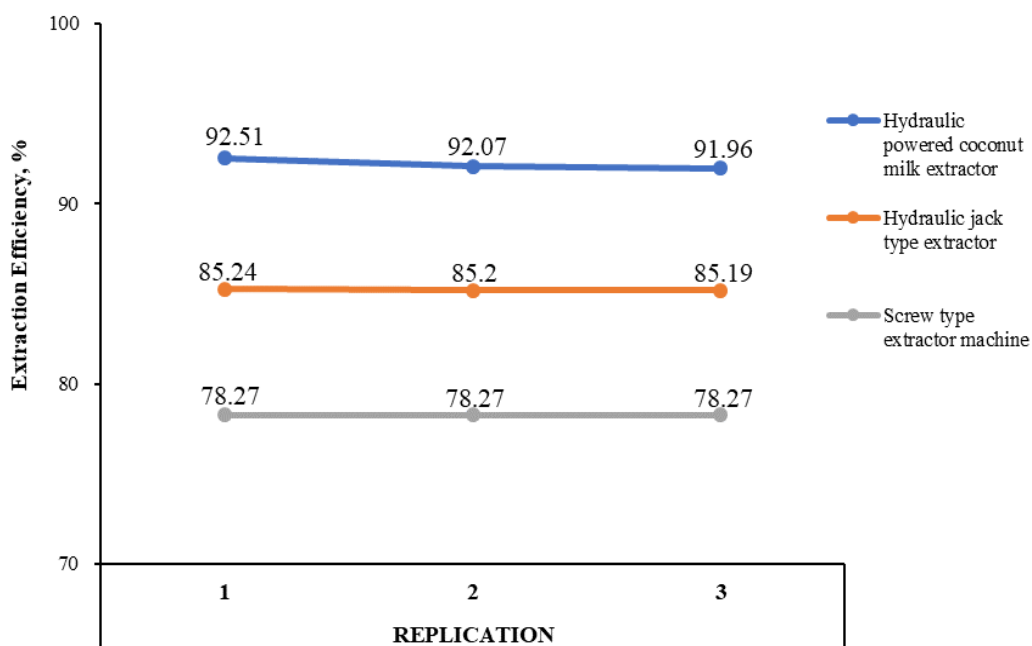


Figure 6 Extraction efficiency of the three extraction machines

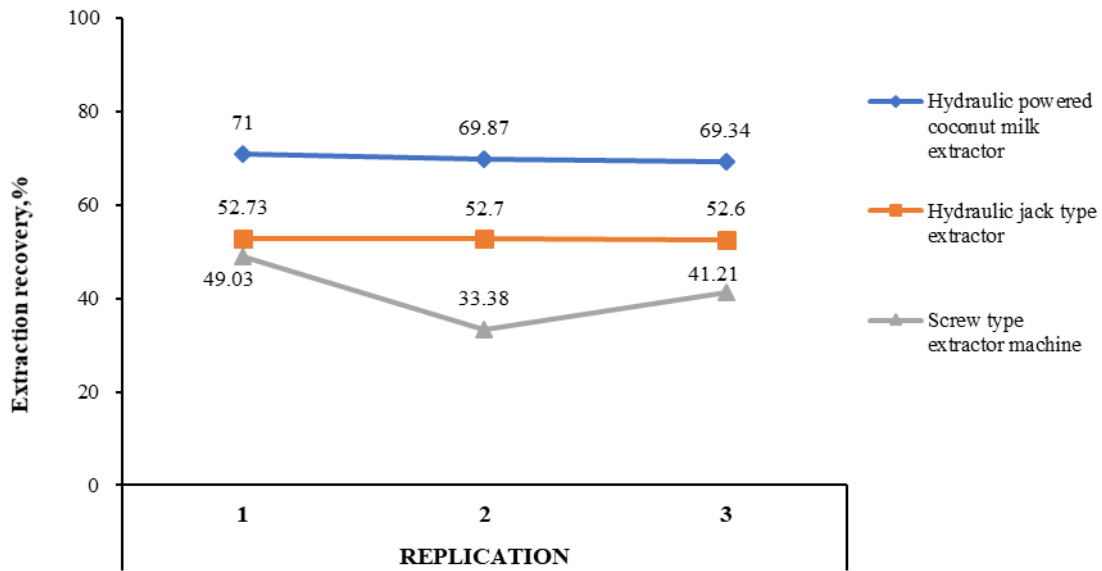


Figure 7 Extraction recovery of the three extraction machines

3.3 Cost analysis

Table 2 presents the financial indicators for the simple financial analysis of the machine, including the break-even point, payback period, and rate of return. The initial cost of the machine is Php 100,000, which covers total material costs, fabrication, and delivery. The estimated lifespan of the machine is 5 years, with a salvage value of 10% of the initial cost.

The analysis indicates that the operating cost of the hydraulic coconut milk extraction machine is approximately Php 144,183.60 per year, while the annual revenue amounts to Php 403,930.80. This

results in an annual net income of Php 259,747.20. Given the annual fixed cost, machine capacity, variable cost, and custom rate, the break-even point for the machine is calculated at 15,435.26 kg of grated coconut meat. The payback period for the machine is approximately 0.35 years, meaning the owner recovers the initial investment before the machine's estimated lifespan ends. This calculation considers the initial cost, salvage value, and annual net income. Additionally, the machine's rate of return is estimated at 180%. Figure 8 illustrates the cost curve associated with the machine's use.

Table 2 Financial analysis of using the machine

Particulars	Value	Unit
1. Annual fixed cost	22,750.00	Php yr ⁻¹
Depreciation	18,000.00	Php yr ⁻¹
Interest on investment	2,750.00	Php yr ⁻¹
Tax and insurance	2,000.00	Php yr ⁻¹
2. Variable cost	121,433.59	Php yr ⁻¹
Operator's wage	102700	Php yr ⁻¹
Repair and maintenance	5000	Php yr ⁻¹
Power cost	13,733.59	Php yr ⁻¹
3. Annual operating cost	144,183.60	Php yr ⁻¹
4. Annual revenue	403,930.8	Php yr ⁻¹
5. Annual net income	259,747.20	Php yr ⁻¹
6. Breakeven point	15,435.26	kg
7. Payback period	0.35	Yr.
8. Rate of return	180	%

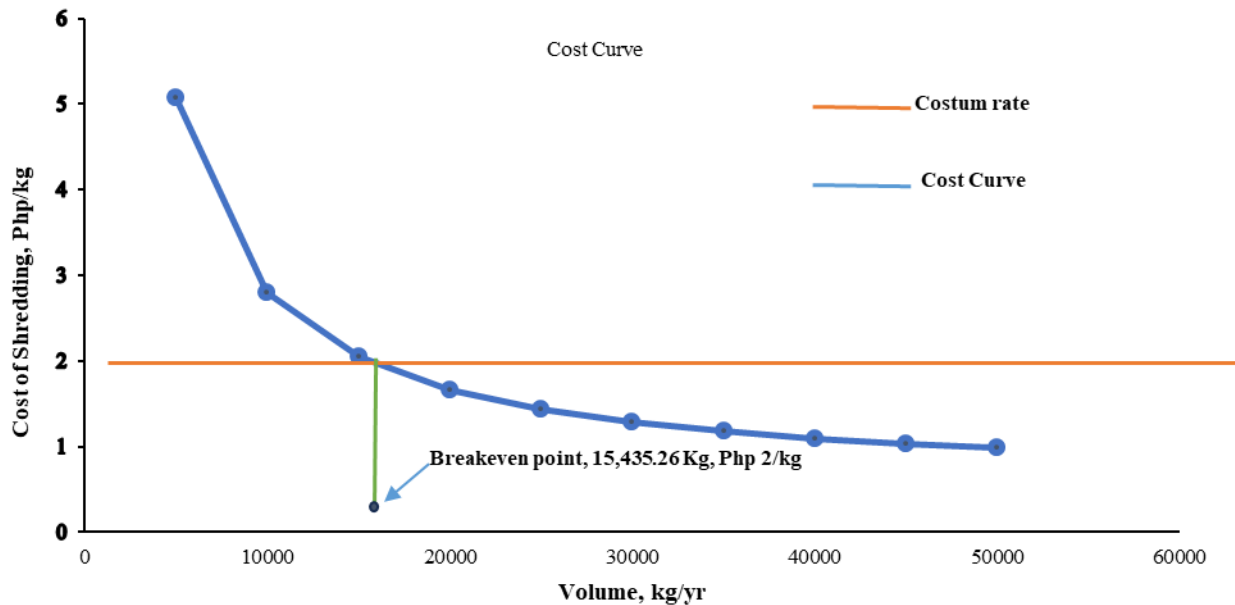


Figure 8 Cost curve of using the machine

4 Conclusions

The objectives of the study were fully achieved in this work by designing, fabricating, and testing the performance of the hydraulic-powered coconut milk extractor made from locally available materials. It overcame some vital problems or challenges posed by most of the coconut milk extractors related to labor intensity, sanitation, and high operating costs. Among others, the developed machine performed well in extraction efficiency, recovery, and capacity. Further, the performance of the machine increased with increased pressure applied.

The hydraulic-powered coconut milk extractor gave a better performance than the conventional hydraulic jack-type extractors on extraction efficiency at 92.51%, recovery at 71%, and extraction capacity at 50.98%. These results therefore mean that a larger number of efficient and productive machines for extraction of coconut milk are being availed to small-scale farmers and businesses. The machine further enhances cost-effectiveness with the low power consumption of 0.54 kWh, and cost analysis revealed that the payback period could be as short as 0.35 years with a high rate of return at 180%.

The general conclusion is that a hydraulic-powered extractor in coconut milk production has been economically viable for reducing manual labor,

improving quality output, and thus making coconut-based enterprise businesses profitable.

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