JATROPHA HANDBOOK

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APPENDIX TO CHAPTER 4 (OF 6)

Oil pressing and purification

1. Practical experience with presses and jatropha

Research institutes, small & medium Enterprises and private parties have gained experience in mechanical pressing of Jatropha Curcas seeds over the last years. A short overview of the findings from some activities is presented below [1,5,8]:

1.2. Mali: FACT jatropha projects in Bamako and Garalo, January 2008

In a progress report Mara Wijnker, M.Sc., FACT Team member reports: Currently for tests a small press with capacity of 14 litres/hour is available. This was locally produced by the military workshop in Bamako. The press has difficulty with pressing the seeds when they are older (and dryer) and because of their hardness.

1.3. Honduras: Gota Verde project update January 2008

A Taby 40A press was imported from Sweden in October 2007. The press has been tested in the CEVER: the press capacity is about 20 kg of dry Jatropha seed per hour. The oil yield obtained was relatively low (20%). More investigation is necessary to determine if this is due to the low oil content of the seeds or the efficiency of the press. Moreover, the press head did not hold the pressure and broke into two parts. The exact reason for this damage is still under investigation.

1.4. Honduras:Gota Verde project

Joost Fokkink from Biofuels BV set up local production and use of a cylinder hole type oil press in Honduras for the Gota Verde project. The press is based on the Täby and BT designs. The processing capacity is 8.5 kg/hr at 23% oil yield. Some adaptations have to be made for jatropha as the first prototype was damaged after pressing a small amount of jatropha seeds.

1.5. Denmark:Dajolka

Niels AnsØ has on behalf of Dajolka been involved in biofuel activities for many years. Niels did some experiments with Jatropha seeds in a BT50 screw press. His main findings were that the press operates better when seeds are crushed before they are fed to the press. Furthermore he reported large quantities of sediments in the oil that came from the press making further treatment of the oil more difficult.

1.6. Netherlands: Eindhoven University of Technology

In 2007 Peter Beerens did his MSc thesis on screw pressing of Jatropha Curcas for application in developing countries. From practical tests at Eindhoven University of Technology and at Diligent Energy Tanzania some significant insights in this process were obtained. Jatropha tests were conducted with the following presses:

- BT Bio Press Type 50 (cylinder hole press), with a capacity of 12 kg Jatropha/hr
- Sayari expeller (strainer press), with a capacity of 70 kg Jatropha/hr
- KEK Keller P0101 (strainer press), with a capacity of 70 kg Jatropha/hr
- Reinartz AP08 (strainer press), with a capacity of 300 kg Jatropha/hr

The most important findings of the press tests where:

- The strainer press has superior characteristics from an operational point of view. The big size of the Jatropha seeds and the relatively high amount of hull cause the cylinder-hole press to

yam more frequent. In case of jamming the strainer press is also more easily cleaned than the cylinder-hole press.

- With proper press settings an oil recovery of around 85% can be achieved. This means that 85 % of the oil present in the seeds is removed, which comes down to 35 liters of raw oil from 100 kg. After filtering 25-28 liters of 'ready to use' clean oil remains. This number is equal for both strainer presses and cylinder-hole presses.
- All tests revealed a high amount of sediments varying between 20-60%. This sediment contains approximately 50% of oil. Either a reduction in the amount of sediment or a filtering method suited to such high amounts of solid material would in potential increase the amount of clean oil by 10-15 percent points.
- Best efficiencies were achieved at low revolutions (30-40 RPM for the BT50). Off course this means lower throughput in kg/hr. Optimizing the nozzle size leads to an increase in oil recovery of around 10% for a cylinder hole press and up to 6% for a strainer press. In addition to the press settings seed conditioning will also affect the oil recovery. Oil recovery appeared highest for low seed moisture level (2-4%) and whole seeds without de-hulling.
- No consistent results were found on the effect of moisture level and pressing temperature on oil quality.
- It is expected that oil temperatures above 70°C increase the amount of phosphor in the oil and further tests are needed to confirm this.

1.7. Netherlands: Wageningen University and Research centre, Department Food Technology Centre

The WUR has started a research program for Jatropha pressing at the end of 2007. Their choice to use a strainer press from De Smet Rosedowns (MINI 200) supports the suggestion by Peter Beerens that a strainer press is preferred for pressing Jatropha Curcas seeds. Currently WUR commenced practical testing with the MINI 200 and aims to make an improved Jatropha press design.

1.8. Germany: Maschinenfabrik Reinartz GmbH & Co. KG

In June 2006 Maschinenfabrik Reinartz GmbH & Co. KG conducted test runs on Jatropha together with Peter Beerens. Results showed an oil recovery of 90% under improved settings.

1.9. Germany: Egon Keller GMBH & Co KG

In June 2006 Egon Keller GMBH CO KG conducted test runs on Jatropha together with Peter Beerens. Results showed an oil recovery of 80% under normal settings. Tests showing higher oil yield were also done, however Keller advised not to use these settings as machine wear would drastically increase due to the high pressures and friction.

1.10. Honduras: FACT pilot project Gota Verde

In April 2008, a press was constructed locally in Honduras, all based on drawings provided by Joost Fokkink (www.biofuels.nl). The design was based on a Taby Type70, cylinder hole press. During the first tests the press ran at 50% rated speed, approximately 25Hz. At that speed the press had a capacity of 8.5 kg Jatropa per hour. At an efficiency of 22.8% clean oil. Using castor a capacity of 13 kg/hr was achieved with an efficiency of 28%.

1.11. Mozambique: FACT pilot project Mozambique with Private farm EVRETZ in Chimoio

Brendon Evans on behalf of EVRETZ, presses cottonseeds with two 6YL-95 presses type Double Elephants, made in China. One of them was bought via ATA in Zimbabwe and the other one in South

Africa. The one from Zimbabwe is performing best. His experience with these strainer presses is that the oil yield is quite low (no specific number available). Crushing the seeds (e.g. with a hammer mill) appeared to improve the oil recovery. After a short time of operation the bearings were worn out and Brendon replaced the bearings for SKF ones. He reported in 2008 that the presses perform quite well. Maintenance is restricted to replacing the complete worm (which is in parts) within one year.
He knows about 10 of these presses with various owners in the region, who are also quite satisfied about the presses.

manufacturer	model	press type: strainer (ST) or cylinder hole (CH)	capacity according to manufacturer, if not available calculated capacity (kg/h seed)	capacity Jatropha (kg/h seed)	minimum operation configuration price (€) (excl. feeder, filter)	price per kg/h seed (€)	Manual (M), Electric (E), Diesel (D)	power (kW)	size - length (m)	size - width (m)	size -height (m)	net weight press (kg)	city, country
KickStart Tanzania (previously ApproTEC)	Mafuta Mali	-	10	7	181	18.1	-	-	-	-	-	-	Bagamoyo, Tanzania
Camartec	Bielenberg Ram Press	-	10	7	200	20	M	-	-	-	-	-	Arusha, Tanzania
BT Maskinfabrik	BT30	CH	9	6	-	-	-	-	-	-	-	-	Dybvad, Denmark
BT Maskinfabrik	BT40	CH	25	18	2,683	107	-	-	-	-	-	-	Dybvad, Denmark
BT Maskinfabrik	BT50	CH	28	20	3,487	125	E	-	-	-	-	-	Dybvad, Denmark
BT Maskinfabrik	BT60	CH	56	39	5,634	101	E	-	-	-	-	-	Dybvad, Denmark
BT Maskinfabrik	BT100	CH	112	78	9,927	89	E	-	-	-	-	-	Dybvad, Denmark
Cimbria SKETGmbH	KP15	ST	285	200	-	-	E	11	2650	1080	500	2100	Thisted, Denmark
Cimbria SKETGmbH	KP21	ST	1042	729	-	-	E	57	5700	1800	900	7500	Thisted, Denmark
Cimbria SKETGmbH	KP26	ST	1200	840	-	-	E	132	7100	2200	1100	13200	Thisted, Denmark
De Smet Rosedowns Limited	Mini 40 electric	ST	40	28	10,668	267	E	4	0.70	0.55	1.45	200	Hull, UK
De Smet Rosedowns Limited	Mini 40 diesel	ST	40	28	-	-	D	4	0.86	0.96	0.70	500	Hull, UK
De Smet Rosedowns Limited	Mini 100	ST	100	70	26,001	260	E	7.5	1.5	0.375	0.5	500	Hull, UK
De Smet Rosedowns Limited	Mini 200	ST	200	140	25,335	127	E	15	2.2	0.68	0.84	900	Hull, UK
De Smet Rosedowns Limited	Mini 500	ST	275	193	29,336	107	E	22	2.3	0.7	0.85	900	Hull, UK
Frandsen Ecotec ApS	40-1	-	100	70	13,415	134	E	-	-	-	-	-	Hobro, Denmark
Goyum screw presses	Goyum 60	-	210	147	-	-	-	14	2.9	0.96	2.15	-	Ludhiana, India
Goyum screw presses	Goyum 100	-	250	175	-	-	-	15	2.175	1.1	2.2	-	Ludhiana, India
Hansen A/S, ABC	80	-	80	56	7,271	91	E	-	-	-	-	-	Randers, Denmark
Hansen A/S, ABC	300	-	300	210	38,488	128	E	18	-	-	-	-	Randers, Denmark
Heizomat GmbH	Heizopress S1	-	10	7	3,649	365	E	0.55	-	-	-	-	Gunzenhausen, Denmark
Henan Doubleelephants Machinery Co LTD	6YL-120	-	200	140	-	-	-	11	1650	630	2360	680	Henan, China
Henan Doubleelephants Machinery Co LTD	ZX-105A	-	250	175	-	-	-	11	2300	1760	1950	980	Henan, China
Hybren ApS	Hybren 60	CH	60	42	8,800	147	E	1.2	-	-	-	100	Uggerby, Denmark
IBG Monforts	Komet CA 95 1-H	CH	2	1	1,650	825	M	-	0.80	0.45	0.46	30	Mönchengladbach, Germany
IBG Monforts	Komet CA59G	CH	7	5	3,600	514	E	1	0.70	0.30	0.40	80	Mönchengladbach, Germany
IBG Monforts	Komet D85-1G	CH	18	13	8,500	472	E	3	1.25	0.60	0.55	210	Mönchengladbach, Germany
IBG Monforts	Komet DD85G	CH	35	25	11,900	340	E	3	1.25	0.60	0.55	210	Mönchengladbach, Germany
IBG Monforts	Komet S120F	CH	85	60	21,475	253	E	7.5	1.67	0.83	1.32	440	Mönchengladbach, Germany
Karl Strähle	SK 60/1	ST	14	10	3,468	248	E	2.2	0.75	0.85	2.30	135	Dettingen, Germany
Karl Strähle	SK 60/2	ST	17	12	5,836	343	E	2.2	0.75	0.85	2.30	194	Dettingen, Germany
Karl Strähle	SK 130/3	ST	130	91	20,391	157	E	7.5	2.33	0.93	0.76	750	Dettingen, Germany
Karl Strähle	SK 190/1	ST	300	210	41,801	139	E	22	4.02	1.07	1.16	4500	Dettingen, Germany
Karl Strähle	SK 190/1	ST	500	350	64,231	128	E	30	5.36	1.20	1.46	7000	Dettingen, Germany
KEK-Egon Keller GmbH & Co	KEK-P0020	CH	20	14	5,100	255	E	2.2	1.5	0.7	0.81	136	Remscheid-Hasten, Germany
KEK-Egon Keller GmbH & Co	KEK-P0101	ST	100	70	17,540	175	E	7.5	2.24	1.1	1.5	920	Remscheid-Hasten, Germany
KEK-Egon Keller GmbH & Co	KEK-P0500	ST	500	350	61,150	122	E	22	4.06	1.59	2.03	3700	Remscheid-Hasten, Germany
Mecanique Moderne, La	Oléane 50	ST	50	35	5,000	100	E	2.2	1.1	0.4	0.5	110	Arras Cedex, France
Mecanique Moderne, La	Oléane 100	ST	105	74	9,000	86	E	5.5	1.35	0.6	0.65	230	Arras Cedex, France
Mecanique Moderne, La	MBU 20	ST	100	70	18,400	184	E	7.5	1.975	0.805	0.875	880	Arras Cedex, France
Mecanique Moderne, La	MBU 40	ST	200	140	25,700	129	E	15	2.318	0.867	0.867	-	Arras Cedex, France
Mecanique Moderne, La	MBU 75	ST	400	280	57,700	144	E	22	2.95	1.795	1.392	-	Arras Cedex, France
New Dawn Engineering	Cooking Oil Press	-	12	8	700	58	-	-	-	-	-	-	Manzini, Southern Africa
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 08	ST	30	21	10,603	353	E	3.4	1.8	0.5	0.8	400	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 10/06	ST	70	49	19,900	284	E	7.5	1.9	0.6	1.1	900	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 12	ST	160	112	28,327	177	E	15	2.7	0.7	1.2	2000	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 14/22	ST	250	175	43,330	173	E	22	3.41	0.89	1.23	2600	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 14/30	ST	400	280	63,211	158	E	30	3.63	0.76	1.22	3000	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 15	ST	750	525	124,894	167	E	45	4.87	1.47	1.68	9200	Neuss, Germany
Reinartz GmbH & Co. KG, Maschinenfabrik	AP 25	ST	1500	1050	221,750	148	E	90	5.685	1.62	2.07	21500	Neuss, Germany
Skeppsta Maskin AB	Täby T20	CH	6	4	909	152	E	0.55	0.4	0.4	0.43	11.2	Örebro, Sweden
Skeppsta Maskin AB	Täby T40a	CH	12	8	2673	223	E	1.1	0.97	0.26	0.3	46	Örebro, Sweden
Skeppsta Maskin AB	Täby T55	CH	28	20	5,045	180	E	1.5	1.02	0.35	0.3	64	Örebro, Sweden
Skeppsta Maskin AB	Täby T70	CH	50	35	7,407	148	E	2.2	1.22	0.3	0.31	95	Örebro, Sweden
Skeppsta Maskin AB	Täby T90	CH	95	67	10,520	111	E	4	1.42	0.4	0.37	160	Örebro, Sweden
Swea Produktion A/S	Swea-15	CH	-	-	3,000	-	E	3	-	-	-	-	Kolding, Denmark
Swea Produktion A/S	Swea-40	CH	30	21	6,000	200	E	1.5	-	-	-	-	Kolding, Denmark
Swea Produktion A/S	Swea-PP	CH	-	-	-	-	E	-	-	-	-	-	Kolding, Denmark
Tiny Tech	Tiny Oil Mill	ST	125	88	9,500	76	ED	9	-	-	-	-	Rajkot, India
United Oil Mill Machinery & Spares Private Ltd	UMAS' TIGER MK-I	ST	-	-	-	-	ED	-	-	-	-	-	New Delhi, India
United Oil Mill Machinery & Spares Private Ltd	UMAS' TIGER MK-II	ST	-	-	-	-	ED	-	-	-	-	-	New Delhi, India
Vyahumu Trust	Sayari (diese)	ST	90	63	1,940	22	D	5.5	1182	1430	904		Morogoro, Tanzania
Vyahumu Trust	Sayari (electric)	ST	90	63	2,200	24	E	7.5	1182	1430	904	322	Morogoro, Tanzania
Universal Equipment Industries	Sundhara	?	100	70	1,100 no eng.	-		7.5	1182	1430	904	322	Bahumukhi Path, India
W. König	W. König	?	15	11	1,026	68	E	-	-	-	-	-	Weiherhof, Denmark
W. Unsöld	W. Unsöld	?	130	91	16,413	126	E	-	-	-	-	-	Herrenberg, Denmark
Mr. Gräf	Mr. Gräf	?	750	525	77,960	104	E	-	-	-	-	-	Ufenheim, Denmark
Yenga hand press	Yenga hand press	?	-	-	-	-	M	-	-	-	-	-	-

Conversion factors for capacity calculation	
seed	factor
General capacity	1
Rapeseed	1
Jatropha	0.7

Conversion factors currency	
monetary unit	value
Euro, EUR	1.00
Danish Krone, DKK	0.13415
British Pound, GBP	1.3334
Swedish Krone, SEK	0.10735
Tanzanian Shilling	0.00060640
Us Dollar, USD	0.68204

Note on oil presses for pilot projects FACT; Jan de Jongh & Peter Beerens