4. スラウェシー産材の乾燥特性
Drying Characteristies of Sulawesi Woods

4.1 Drying Test in the Oven at 100°C

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100 °C のスケジュール推定試験

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4.1.1 Purpose

The purpose of this study is to establish drying schedule for one-inch board of some woods from Togian Island, Sulawesi, Indonesia, by means of 100°C-test.

4.1.2 Experimental Procedures[1)]

The flat-grain board was chosen from each species. All the chosen boards were heart-wood and green condition, and then were planned, trimmed and cut-off to be specific size of 2.0 cm x 10 cm x 20 cm in thickness, width and length respectively. From every species two test specimens were taken for this study.

The test specimens were measured its initial weight, width and thickness, and then were put in the oven at 105 ± 5°C until reached oven-dry condition. During the first six-hour, every hour the test specimens were weighed and observed in defects, i.e. end- and surface-check occurrences. Afterwards, observation was done every two to five hours, and longer when the test specimens were reaching oven-dry condition. During the observation, if the checks occurred, the moments of maximum check and closing check were observed corresponding to its moisture contents. The moment of closing check was supposed as the moment of drying stress reversal.

When the test specimens reached oven-dry condition, those test specimens were taken out from the oven and then directly were measured its weight, width and thickness. Afterwards, the test specimens were cut-off in the middle part to be measured its deformation and observed whether honeycomb occurs or does not.

By this work it was gathered data about grade of initial check, deformation, honeycomb, drying-stress reversal and requiring time to reach 1% moisture content. These data can be used to set-up the drying schedule for one inch board and required time to reach 10% moisture content for each species can be estimated referring to Terazawa's Method.[1)]

4.1.3 Result

The result of 100°C-test is shown in Table 1. The values taken from 100°C-test are average values, except the grade of defects are presented in actual values to know characteristics variation of the wood.

The drying condition is inferred from the most severe grade of defects, so it will be the mildest-one and more safely. The drying time indicates estimation of required-time to dry the wood from green condition to 10% moisture content by its drying condition for one-inch board.

From 29 experimental items, there consist of 23 species and the others are species duplications but from difference logs. The wood density is varied form 0.20-0.93 gr/cm^3 with average

value 0.48 gr/cm^3 and standard deviation 0.14 gr/cm^3.

The initial moisture content also has wide range, from 40-260%, with average value 84% and standard deviation 43%. Because of large wood-properties variation, so the result of 100°C-test and inferred drying condition are large variation also, as shown in Table 1.

4.1.4 Discussion

The drying condition is inferred from the most severe grade of defects from 100°C-test, so it will be the mildest-one. It is hoped that the drying condition can be modified to be more severe-one, especially for high grade board. But, sometimes the inferred drying condition does not match which causes severe defects on the test board. In this case, the drying condition must set-up to be milder-one.

Modification of drying condition can be done by referring to the result of 100°C-test, i.e. the grade of deformation, honeycomb, initial check, and required-time to reach 1% moisture content. If the grade of deformation and/or honeycomb are high indicate the wood tends to collapse, so the drying temperature should be not high. In other case, if the required-time to reach 1% moisture content is short indicate that the movement of water in wood is very easy, so the initial depression can be set-up at larger one than the result of inferred drying condition.

Changing drying condition can be done as described by Rasmussen.[2] The initial drying condition is kept until moisture content lost 1/3 of its initial moisture content, and then the drying condition can be changed. But, if the species has moisture content lower than 20% at stress-reversal, so the changing drying condition must be done at lower moisture content than usual schedule.

References.

1). Terazawa, S. 1965. An easy method for the determination of wood drying schedule. Wood Industry, Vol. 20(5), Wood Technological of Japan.

2). Rasmussen, E.F. 1961. Dry kiln operator's manual. USDA Agriculture Handbook. No. 188.

4・1・5 概　　要

100℃のスケジュール推定試験

2㎝厚の板目心材生材2枚づつを100℃に調節した乾燥器に入れて急速乾燥し，その際に発生する損傷を区分けし，材の乾燥特性を知り，1インチ材の乾燥スケジュールと乾燥日数を推定する試験である。

供試材は29種類で，その内容は23の属から成り立っている。供試材の樹種，全乾比重，初期含水率や，求められた乾燥条件等はTable 1に総てまとめられている。

応力転換時含水率の測定は，表面割れが閉鎖した時とし，この含水率を確認すれば乾湿球温度差を開きはじめる時期の決定に役立つ。

応力転換時含水率の低いものは低含水率まで乾湿球温度差を一定に保つ必要があり，Rasmussenが提唱している初期含水率の⅔に含水率が到達すれば，乾湿球温度差を開きはじめてよいと言った法則に総ての樹種があてはまるとは言えない。

Table 1. Drying Conditions Which are Infered from 100°C-Test.

No.	Wood Species	Density[1] (gr/cm³)	Initial Moisture Content (%)	Grade of Defects[2]			Time to 1% MC (hr)	MC at Stress-reversal (%)	Shrinkage[3]		Infered Drying Conditions			Estimation of Drying Time 2.7 cm board (day)
				Initial Check	Deformation	Honey comb			Tan. (%)	Rad. (%)	Initial DBT (°C)	Initial DBT-WBT (°C)	Final DBT (°C)	
2.	*Koordersiodendron sp.* (1)	0.80	76	5-6	5	6	56.4	20	5.9	13.9	45	2.5	70	15.3
7.	*Canarium sp.* (2)	0.56	115	3	1-4	1-3	23.4	10	5.3	5.5	50	3.8	77	7.5
12.	*Santiria sp.* (2)	0.67	43	4	2-3	1	34.0	10	6.5	7.0	55	3.6	83	8.7
14.	*Lophopetalum sp.*	0.42	97	3	1	1	16.8	15	5.7	4.8	60	3.6	85	6.3
15.	*Terminalia sp.* (1)	0.41	43	5	1	1	17.0	10	6.5	3.7	53	3.0	82	7.5
17.	*Terminalia sp.* (3)	0.67	40	3-4	1	1	33.0	14	7.1	5.1	57	4.0	84	8.0
18.	*Terminalia sp.* (4)	0.61	41	2	1	1	27.9	10	6.4	5.0	65	5.5	90	6.0
23.	*Octomeles sp.*	0.34	97	2	4	2-3	24.9	30	5.0	9.0	50	3.8	77	7.3
28.	*Gonystylus sp.*	0.52	67	4-5	1	1	18.2	15	7.1	4.0	53	3.0	82	7.7
29.	*Calophyllum sp.* (1)	0.50	70	1	2-3	1	26.0	20	7.6	6.5	58	4.7	83	6.0
32.	*Litsea sp.* (2)	0.48	59	2-3	2-3	1	24.0	20	5.7	6.0	58	4.3	83	6.4
33.	*Litsea sp.* (3)	0.53	140	2-3	1-2	1	39.3	30	5.6	5.2	60	4.3	85	8.6
39.	*Dysoxylum sp.*	0.57	81	2-3	4	1	50.7	28	6.9	9.4	54	4.0	80	9.8
40.	*Sandoricum sp.* (1)	0.41	94	2-4	1	1-2	19.0	20	6.5	4.4	55	3.6	83	6.6
42.	*Artocarpus sp.*	0.28	260	1-2	4-5	1	20.0	40	8.4	6.9	50	3.6	77	7.0
44.	*Ficus sp.* (2)	0.49	114	2-5	4-5	1	16.6	25	11.6	8.6	50	3.0	77	6.9
45.	*(Myristicaceae)* (1)	0.50	105	1-2	2	1-3	16.8	33	8.5	6.9	50	3.8	77	5.8
47.	*Eugenia sp.*	0.80	95	5-7	2-6	5	52.1	15	8.1	16.0	47	2.0	71	17.2
49.	*Podocarpus sp.* (1)	0.47	53	3-4	1	1	17.6	11	6.6	4.0	55	3.6	83	5.7
53.	*Pometia sp.* (1)	0.70	70	5	1-4	1	40.3	10	5.8	9.6	53	3.0	80	10.8
55.	*Madhuca sp.*	1.08	41	6-7	4-6	6	59.9	10	5.9	8.1	45	2.0	70	18.3
56.	*Palaquium sp.* (1)	0.46	63	1-2	1	1	20.0	32	6.9	4.2	65	5.5	90	5.3
57.	*Palaquium sp.* (2)	0.60	99	2	5	4	39.8	20	5.6	10.1	49	3.3	73	10.0
61.	*Ailanthus sp.* (1)	0.39	73	3-5	1	1	14.0	30	6.8	3.9	53	3.0	82	7.1
62.	*Ailanthus sp.* (2)	0.44	102	2-3	1-2	1	16.3	30	10.2	5.9	60	4.3	85	5.3
63.	*Duabanga sp.* (1)	0.42	60	1-2	1	1	32.0	25	5.3	3.9	65	5.5	90	6.9
67.	*Heritiera sp.* (1)	0.50	62	2	2-4	1	27.0	25	5.8	7.4	56	4.4	82	6.8
68.	*Heritiera sp.* (2)	0.59	63	4	2-3	1	30.6	15	7.4	7.2	55	3.6	83	8.3
72.	*Sterculia sp.* (1)	0.20	125	1-2	1-2	1	6.5	20	5.2	2.0	66	6.0	88	2.8

Notes: 1) At oven-dry condition.
2) Classification by Terazawa
3) At oven-dry.