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# Experiments of Heating Effects on Bowling Ball

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# Introduction

- In the bowling ball industry, we have been looking for a solution to extract oil coming from the lane effectively and thoroughly.
- There are several ways to remove the oil from the ball, and the most convenient way is to use bowling ball cleaner after every game, to treat the surface of the ball. The most of the solution may remove the oil but the removal is usually only limited to the surface of the ball.
- The extended use of the ball, especially after 30 games or more, induces deeper penetration of the oil into the ball which is porous in nature.
- Once the oil penetrated deep into the ball, the conventional method of extracting the penetrated oil is heat treatment : 1). Oven, 2). Hot Water Bath, and 3). Steam Wash and Ultrasonic with Surfactants. Those methods require well-controlled temperature to avoid temperature gradient between the core and the surface of the ball. Higher temperature gradient will eventually damage the integrity of the ball. In order to achieve the maximum extraction, the machine has to designed and built specifically for this purpose..
- In this paper, we present the data derived from **experimental video on 07/15/2013** (Ref.1) **produced by HEIWAJIMA STAR BOWL performed by Mr. Kazunori Tokue and Mr. Daisuke Fujikawa who are the professional bowlers in Japan** and show the real impact of the heat to the ball.

# Experiment

## Method

### 1. Prepare 3 balls

#### ① Premium SWING

- Used for 300 games
- Out of box hardness: 74~76°
- Cover stock: NE2 Maxx Premium

#### ② Dyna Star

- Used for 150 games
- Out of box hardness: 74~76°
- Cover stock: MS2.0

#### ③ NANODESU AccuSwing

- Used for 200 games
- Out of box hardness: 74~76°
- Cover stock: NANOXY Super Solid w/Fullerene C60



(... continues)

# Method – Ball ① (continued):

2. Measure the hardness of the ball ① and log the data.



3. De-oil the balls as follows:

- Put ball ① into 50°C hot water bath for 15min.
- Clean the ball by a cleaner and leave it until it becomes room temperature.
- Repeat the step a. & b. 5 times.

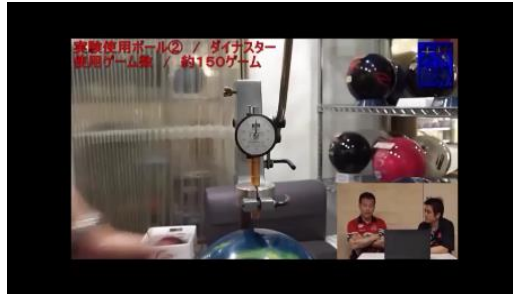


4. Measure the hardness of the ball ① and log the data.



# Method – Ball ② (continued):

5. Measure the hardness of the ball ② and log the data.



6. De-oil the balls as follows:
- Put ball ② into REVIVER (60°C) for 15min.
  - Clean the ball by a cleaner and leave it until it becomes room temperature.
  - Repeat the step a. & b. 5 times.



7. Measure the hardness of the ball ② and log the data.



# Method – Ball ③ (continued):

8. Measure the hardness of the ball ③ and log the data.



9. De-oil the balls as follows:
- Put ball ③ into ION BALL CLEAN for 15min.
  - Clean the ball by a cleaner and leave it until it becomes room temperature.
  - Repeat the step a. & b. 5 times.



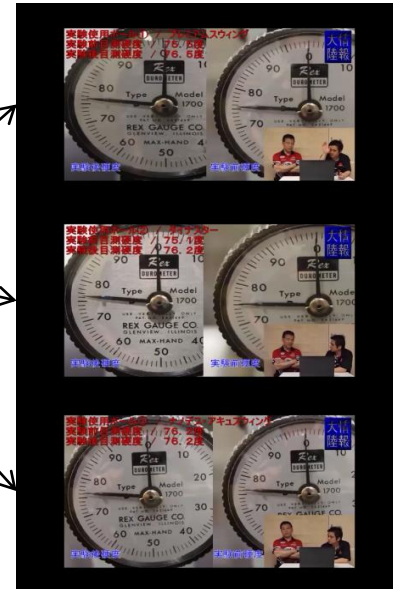
10. Measure the hardness of the ball ③ and log the data.



# Results and Considerations

## Results:

	Ball	Hardness Before De-oiling	Hardness After De-oiling	Difference
Hot Water	①	75.5°	76.5°	1.0°
REVIVER	②	75.1°	76.2°	1.1°
Ion Ball Clean	③	76.2°	76.2°	0.0°



## Observations:

- Using 50°C (122° F ) hot water (not a high temperature) or de-oiling machine designed specifically for bowling ball still **increased the hardness of the ball.**
- Ion Ball Clean which does not use heat did not increase the hardness.
- The measurement points are limited and may not be the same points at before and after.

## Conclusions:

- We can **conclude that the heat will make the ball harder.**
- We may not be able to conclude that this is because the plasticizer was extracted by the heat since we could not do further analysis, but it is the most suspicious reason. And if it is true, increasing the hardness **makes the ball brittle (less plasticizer).**
- In addition, increasing the hardness degrade the frictional resistance between the ball and lane... so that you have to change your texture (pores of the cover stocks) of your ball and also you have to maintain the texture more frequently since it is brittle.
- Given these, it is better to use a de-oiling system which does not require the heat.**

# Reference

In this paper, we used the data from the following video.

**Ref. 1 Tokue-Pro To Fujikawa-Pro No “SNC Bowling Jyoho Tairiku  
Bangai Hen Sono San”**

(徳江プロと藤川プロのSNCボウリング情報大陸 番外編其の参 (07/25/2013))

<https://youtu.be/ph8zJlfN8bM>