Failure Analysis of Hollow Spherical Plastic Products

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Abstract. Hollow spherical plastic products, yoga balls, etc. are emerging sporting goods, and there is no systematic analysis on its burst property and corresponding testing methods. This paper systematically establishes the test methods for the weight bearing and explosion-proof of such products, and evaluates its safety from its defect’s factors. Also, in-depth analysis of the causes of its failure factors.

1. Introduction

Generally, yoga ball is also known as exercise ball, its first name is called Swiss ball. Due to the development of yoga sport in China, Chinese people call such ball the yoga ball. The yoga ball is made of soft elastic also known as fitness ball or yoga ball, is a ball sport tool that fits sports and fitness. The material is mostly made of soft PVC material. When the human body comes into contact with it, the internal inflatable fitness ball will evenly touch the contact parts of the human body to generate a massage effect, which is beneficial to promote blood circulation. The yoga ball's action arrangement is aimed at the main parts such as the abdomen, back, and waist. During exercise, it is necessary to cooperate with slow, rhythmic breathing to stretch, squeeze, etc., so that the muscles can effectively massage, relax, and consume fat. An ability to improve concentration, reduce mental stress, and enhance the endurance of the limbs and spine [1].

There are several benefits of practising the yoga ball practice. First, yoga fitness ball has a strong interest, soft and very flexible. When the practitioner performs ordinary equipment movements, such as treadmills and sit-ups, the athlete can only consume heat by repeating several actions for a long time, which makes the exercise process of the athlete very boring and boring. Yoga ball exercises have changed the way of training in the past, allowing the athletes to play with the ball with the music of the passionate and unrestrained. Therefore, the yoga ball is very entertaining. Second, yoga fitness ball helps to exercise the balance of the human body, colleagues consume a lot of heat. The general exercise is carried out on fixed mechanical equipment, and the yoga exercise ball is a soft and flexible device. It can exercise our balance ability anytime and anywhere, so that we can not relax, and need strong support yoga at any time. The fitness ball will therefore constantly burn our excess fat. Third, yoga fitness ball also has a strong massage function, the highest state of yoga ball is the integration of human and ball, yoga ball exercise design strives to achieve full contact between the human body and the spherical surface, and the yoga ball is made of soft PVC material Made, when the human body comes into contact with it, the internally inflated yoga ball will evenly touch the contact parts of the human body to produce a massage effect, which is beneficial to promote blood circulation[2,3].

There are two kinds of yoga balls on the market, explosion-proof materials and pearlescent materials. The explosion-proof ball is made of high-grade explosion-proof material, which feels soft like a sponge. At the same time, it has the pressure resistance and flexibility of the tire and the high elasticity of the
spring. It can withstand the weight of about 400 kg, and it is safe and secure. The pearly material of the yoga ball has a smooth surface and good reflectivity, but in the process, only some pearl powder is added inside, and the thickness is thinner than the explosion-proof material.

Either way, the average weight yoga ball can be tolerated. Moreover, when we exercise, we don't put all the weight on the yoga ball. It just carries a part of the weight. Because our body and the ball produce a counter-strength, the yoga ball allows us to relax and sink, while our body will have a force of its own upwards, while the muscles are tightened to wrap the bones to protect our body.

The material of the yoga ball is made of soft PVC material, which is flexible, so it will not explode when lifting, riding, lying, shooting, kicking, pressing, sitting on the top, unless there is too much aining, there may be an explosion phenomenon. When you get a sharp thing, it will burst. Therefore, remind everyone that when inflating the yoga ball, it is best to fill the eight points, the ball body is more flexible, easy to do the clamping and gripping action.

But there will be exceptions to anything. There is a man in foreign countries who is seriously injured by the explosion of yoga balls. Therefore, we must pay attention to our safety when using yoga balls. First of all, pay attention to the quality of the yoga ball when buying it, try to buy some high quality yoga balls produced by regular manufacturers. Secondly, don't overfill when inflating it, because the chances of exploding the ball will be higher, and it is not very convenient to use a particularly large ball[4].

In addition, the storage of the yoga ball also requires special attention. Its material is similar to the material of the tire. It may explode in high temperature environment, so avoid the direct sunlight and high temperature when storing the yoga ball. Finally, be careful when you use the yoga ball. The yoga ball is slippery. You can put a yoga mat or towel under the ball to prevent it from slipping. Even if the quality of the yoga ball is good, accidents will inevitably occur under the influence of external force. Therefore, try to avoid sharp objects touching the yoga ball during exercise. In fact, the yoga ball is an important device for weight loss. Doing some soothing exercises on it can also effectively stretch the muscles and relax the body.

This aim of this work is to analysis the burst factor of yoga ball. Because there is no corresponding product standard specification, it has potential harm to consumers. This study first established an experimental method for testing the bursting of yoga balls, analyzing various factors from experimental methods, and finally analyzing various explosions on yoga balls.

2. Materials and equipment

The weight-bearing test of the yoga ball, inflating the yoga ball to the standard size, or normal use of air pressure. The platen area is not less than 400*400 mm, and a force of 250 kg (or the nominal maximum load-bearing weight) is applied to the platen for 5 minutes. The yoga ball should not break and be used normally.

The explosion-proof test of the yoga ball, inflating the yoga ball to the standard size, or normal use of air pressure. The platen area is not less than 400*400 mm, and a force of 100 kg is applied to the platen, then the needle is used to poke, the yoga ball does not explode, and the leaking state should last for more than 5 seconds.

3. Results

Figure 1 shows computer simulation result of the test, the sphere is cutting into 32 segment and 16 rings. Generally, the ball is uniform and its explosion is only related to its pressure. If the ball has some defect, or the thickness of the ball is not uniform, there would be high risk of explosion. Figure 2 shows the factors of yoga ball burst, the most highest potential of yoga ball burst is pierce, then thickness, defects and overloading.
4. Discussion
There are two kinds of yoga balls on the market, explosion-proof materials and pearlescent materials. The explosion-proof ball is made of high-grade explosion-proof material, which feels soft like a sponge. At the same time, it has the pressure resistance and flexibility of the tire and the high elasticity of the spring. It can withstand the weight of about 400 kg, and it is safe and secure. The pearlescent material of the yoga ball has a smooth surface and good reflectivity, but in the process, only some pearl powder is added inside, and the thickness is thinner than the explosion-proof material.

The size of the yoga ball is 45 cm, 55 cm, 65 cm, 75 cm, etc. If it is a petite woman, you can choose a yoga ball of 45 cm or 55 cm, and a yoga ball of 65 cm and 75 cm is more suitable. For tall men. In addition to the choice of size, it is more important to choose a durable yoga ball produced by a regular manufacturer, which is very flexible and full of safety.

Practicing yoga balls requires the trainer's attention to be more concentrated, because the yoga ball needs better balance, not only to control his body well, but also to control the yoga ball under the body, which is also interesting in the yoga ball project. There must be an interactive process between the body and the ball, and both can focus on achieving the best fitness results.
Because the yoga ball can carry the local pressure of the body, when the lumbar vertebra is placed on the yoga ball, we can temporarily relax our lumbar vertebrae, while strengthening the strength around the lumbar vertebrae or limbs, after practicing for a period of time, when the lumbar vertebrae and limbs are strengthened, we will not use the strength of the lumbar vertebra to do any movement, so the lumbar vertebra will be recovered and slowly consolidated. Because the yoga ball has good elasticity, it will make the lumbar spine feel very comfortable and relaxed when relying on it.

Please note: When you cheer on the ball, hit the "eight points full", so that the ball body is more flexible, easy to do the clamping and gripping action; when playing yoga ball at home, you can put a yoga mat or cloth on the ground Keep it clean and not easy to slip; although the yoga ball is not easy to be injured, it is necessary to pay attention to balance, especially the more difficult movements such as wheel type. When restoring, you must hold it by hand; yoga balls come in various sizes. Beginners can use small balls first, which is more convenient to control. In general, the big ball is easier to maintain balance, the ball is lighter, but not easy to balance.

5. Conclusion
Generally, the yoga ball is safety for use, but some manufacturers cut corners and shoddy, and brought a lot of hidden dangers to the market. This paper standardized the test methods of yoga balls, and classified the factors affecting yoga balls, mainly from the internal and external factors, yoga The quality of the ball itself, whether the user is using it correctly. Provide consumers with a reference

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