Importance of Natural Materials for Good and Quality Sleep

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ABSTRACT

We are witnessing huge environmental pollution around the world. Excessive use of artificial materials has a very detrimental effect on our health. In order to prevent pollution, to stimulate the development of the wood- and furniture industry, agriculture and related activities, it is necessary to encourage people to use natural materials as much as possible. Sheep's wool is a unique and significant product that characterizes the animal species and is an example of neglected material. On the other hand, we have good utilization of wood, but there should be a greater degree of finalization of the product in Republic of Croatia. New ideas would stimulate new investments for the development of the mattress industry and enable the economy to develop. However, the aim of the paper is to remind users of the beneficial properties of natural materials and to encourage them to choose natural materials when purchasing furniture for sleeping. By choosing natural materials, in addition to not destroying the environment, we can ensure better and quality sleep, as well as prevent some health disorders, such as allergies. In addition, the production of products made from natural materials would be encouraged.

Key words: natural materials, wool, cotton, latex, wood, sleep, mattress

1. INTRODUCTION

The planet Earth inhabits plants, animals and humans that strive to live in symbiosis and create optimal equilibria on Earth. The whole system works ideally if that balance is established. It is necessary for people to respect nature to enjoy a comfortable and quality life. Civilization developed through different eras and periods. These developments have brought significant benefits and improved the quality of human life; however, some developments have disturbed the balance. Guided by those thoughts, it is necessary to spread awareness about the pollution of the environment on a daily basis to artificial materials, because materials that are not rapidly degradable or recyclable are creating a long-term problem for our planet. Using natural and environmentally friendly materials, we contribute to the positive planet development. At the same time, greater demand and importance for natural materials would encourage their production. One such, very significant and unique material of animal origin is sheep's wool. For example, the Republic of Croatia uses only half of its total production of wool and the rest ends up as waste polluting the environment (Stracenski Kalauz et al., 2013).

Every life on Earth needs to renew and receive energy. Unique way of renewal energy, like recharging batteries, for the people is to lie down, rest, dream and enjoy. One of the objects, which allows human activity that meets all these needs, is – the bed. Through the development of civilization, humans have successfully assembled a set that serves us to sleep. The bed system is an assembly of frame, mattress and pillow (Grbac, 2006). By choosing natural materials, in addition to not harming the environment, we can ensure even better sleep quality, as well as prevent some health disorders, such as allergies.

This paper contributes to a better understanding of the importance of the role of natural materials in the daily life of human beings, and especially for sleeping and application of natural materials in the design and construction of bed systems. Paper is based on a research by several
authors who highlighted and prove the benefits of cotton, wool, latex and wood in the production of healthy beds and sleeping areas.

2. RESEARCHES OF NATURAL MATERIALS IN BED SYSTEMS

The selection of materials for the bed system directly affects the health and sleep of the user. After researching the literature and the overall knowledge of the bed system and mattress construction, choosing the adequate materials in its design is a very important step. An eco-friendly and health-friendly bed system requires the use of natural materials, and for this reason, materials that are available in nature have been selected for the purposes of this work. Moreover, through studying the literature it has been confirmed that those materials have a positive effect on human health during sleep and rest.

Textiles, especially clothing, interact dynamically with skin functions. Mechanical properties like roughness of fabric surface are responsible for non-specific skin reactions like wool intolerance or keratosis follicularis (Wollina et al., 2006). With the worldwide expansion of synthetic textiles the need for antimicrobial impregnation of textiles increased substantially as synthetic textiles absorb about 25% less water vapour compared to cotton or wool. The blocking of evaporation of sweat results in a thin fluid film on the skin, which consequently impairs further the evaporation of sweat, providing an ideal environment for proliferation of bacteria and fungi. Soon, commercial interest was direct to the antimicrobial impregnation of natural fibres (Kramer et al., 2006).

2.1. Cotton

Cotton is the natural material that is the most appreciated biodegradable material in the textile industry. It is considered as an ideal filling material in the mattress construction layers. Due to its texture and soft touch, as well as health-friendly textiles, this material fits perfectly with the concept of natural mattress.

Cotton is one of the most used product in the fashion industry. Unfortunately, most used cotton is produced with large amounts of pesticides that affect not only the environment, in which they are grown, but also the workers who harvested them and the people who wear them. Organic cotton is planted using the natural method of cultivation and has a significantly less harmful effect on the environment and as such has a higher level of quality and comfort. Organic cotton farms instead use natural techniques to protect against insects that are a threat to plants, such as covering with natural materials (Web 1).

Cotton is the most commonly used textile for patients with atopic dermatitis; it has wide acceptability as clothing material because of its natural abundance and inherent properties like good folding endurance, better conduction of heat, easy dye ability and excellent moisture absorption. In addition, its easy biodegradability is an added advantage.

However, it suffers from drawbacks like inflammability, poor crease retention and is prone to bacterial and fungal attack (Ricci et al., 2006). Cotton fibres are sensitive to acids but are highly resistant to alkalis and organic solvents. The aging of cotton fibres is very good (if kept in a dry and sheltered place from the sun, the loss of strength for 50 years is minimal) (Kovačević, 2009). In addition, its simple biodegradability is ideal for the needs of today's ecological management (Ricci et al., 2006).

Another benefit of organic cotton and the disadvantage of using pesticides, is that it is far better for human health. This is mainly due to respiratory problems that can be caused by the chemicals used to grow cotton. It has been shown to affect other people living near inorganic cotton farms. Furthermore, people carrying inorganic cotton may also be exposed to the residual
amount of pesticides that can be absorbed through the skin. The non-organic cotton and chemicals used have been shown to cause many health problems, such as attention deficit hyperactivity disorder (ADHD), a weakened immune system, and even birth defects. The benefits of organic cotton are evident through their environmental impact, their impact on human health and the fact that they last longer and are more comfortable (Web 1). For this reason, cotton as a material in today's rapid stressful life is an ideal material for relaxing users, which is why cotton is suggest for use in fine mattress filling and in a part that is in direct contact with human skin.

2.2. Wool

Wool is a traditional natural material that has been beloved for centuries, it is ideal for implementation in mattress construction. Wool is a natural material that has been synonymous with softness and warmth for many years. Croatian mattress manufacturers also produce mattresses filled with natural materials such as wool and cotton. Marković (2017) found that three observed Croatian manufacturers have different models with this type of fine filling in their production gamma. In the first company, just two mattress models from entire production gamma are fill with wool. The quality of the wool contained in these mattresses is 400 g/m² of weight in combination with cotton of 200 g/m². Second manufacturer has only one mattress, which incorporates wool with a weight of 110 g/m² in combination with polyurethane fibres. While the third manufacturer has five models of mattresses filled with 300 g/m² quality of wool. With such properties, this traditional natural material is ideal for filling a mattress in which it is intend to use wool fiber in a second layer, below a fine cotton pad.

An aversion to next-to-skin wool garments has been attributed to discomfort or a sensation of prickle, and beliefs and experiences with wool in childhood can influence future use (Sneddon et al. 2012; Sneddon et al. 2012). Prickle is understood to be mechanical irritation to the skin by coarse fibre ends indenting the skin and activating nerve endings (Garnsworthy et al. 1988; Naylor, 1992; Naylor et al. 1997). Fibre, top, yarn, and fabric factors can influence the tendency of a fabric to exhibit prickle (Naylor, 1997; Naylor et al. 1997) e.g. length of fibre protruding from the fabric surface, presence of coarse fibre ends (Naebe et al. 2014). Methods for overcoming prickle effects include enzyme treatments (of fibers, yarns, fabrics e.g.) (Bishop et al. 1998; Das and Ramaswamy, 2006), and modifying yarn structure (Miao et al. 2005) (cited in: Laing and Swan, 2015).

Sheep's wool is a very fine mattress filler as it has good thermoregulatory properties. Its natural property is to absorbing moisture and evaporates it. Also, wool creates a dry and healthy sleeping climate. Such thermal properties are very important to humans because the human body sweats and loses half to one and a half litres of fluid at night, and its dry climate makes it possible to retain body heat. In addition to its excellent thermal properties, the wool fiber is permanently elastic, durable in shape and has very good anti-rheumatic properties. Wool is a material that has the ability to regulate the climate and create a sense of comfort. Due to such abilities, wool material will not be able to completely replace any other artificial fiber (Grbac and Ivelić, 2005).

Recent evidence confirms perception of warmth is affected by perception of wetness with warm temperatures suppressing the perception of wetness (Filingeri et al. 2014). Further, surface wetness of fabrics in contact with the skin influences more general perceptions of comfort (Scheurell et al. 1985). The thermal resistance of wool fabrics has also been attributed to improvement in specific aspects of user health. Use of wool undergarments (and bedding) over a six-week period was reported to reduce symptoms and drug use of patients suffering from fibromyalgia (Kiyak, 2009) (cited in: Laing and Swan, 2015). Details on construction,
mass per unit area, thickness, and laundering practices were not reported for either the undergarments or the bedding (Laing and Swan, 2015).

2.3. Latex

The modern era has made various innovations today. Originally latex is a white milky juice that is extracted from many plants, the most famous being rubber tree (*Hevea brasiliensis*). Natural latex is very expensive and demanding for production, which is why chemical treatment of latex is now possible to profit in various technological ways (Marković, 2019).

The mattress core can be design in various materials such as spring cores or polyurethane foams, however, the natural material that today occurs as the mattress core is the natural latex foam. Nevertheless, it is very important to note that nowadays this natural share in the production of latex foam is diminishing, and latex is based on artificial materials that mimic the properties of true natural latex (Marković, 2019).

There are different methods of obtaining a latex core, and one of them is "talalay" method. "Talalay" latex refers to the method in which the latex is formed. In this process the rubber is agitated into foam and poured into a mold and sealed in a vacuum. The mold is then flash-frozen to stabilize the rubber and subsequently heated to assure evenness and a consistent cell structure top to bottom and edge to edge. Latex mattress cores are perforated with holes. The size of the holes determined the softness of the core. The latex mattress cores contained sections with different sized holes regulating the softness in selected areas based on the participant’s sleeping position (Jacobson et al., 2010).

The spring core mattresses, due to their construction and springs, provide excellent support and are known as "firm" and "hard" mattresses. Unlike mattresses that have a latex core, they are a very economical, yet quality product (Grbac and Ivelić, 2005).

Latex foam is a material that provides high quality support for the spine, because when loaded it adopt to the shape of the body, which makes such material extraordinary for such support.

Through the study of Low et al. (2016) found that latex foam can be an excellent replacement for polyurethane foam and spring core. Results in the same study confirmed that a latex foam core was ideal for the construction of hospital beds because the use of a latex core could significantly reduce the stiffness of a patient's muscles and joints. The ability of the latex mattress to achieve a more even and lower distribution of stress regions across the body can be attributed to its mechanical properties. Once such a core has been implemented, the mattress construction is complete and meets all the requirements and criteria laid down on the mattress: the materials are natural, physiologically acceptable with thermal balance and good permeability, outstanding durability and elasticity, with indispensable comfort and hygienic durability, but also unavoidable aesthetics.

In a study (Jacobson et al., 2010) patients with back pain and sleep disorders had significant improvements when they slept on a sleep surface constructed of layers of viscoelastic polyurethane foam and latex.

Lee and Park (2006) in their study on the impact of mattress type on sleep quality and skin temperature, found that sleep efficiency and skin temperature were higher when subjects slept on an "uncomfortable" mattress. In addition, different bedding systems have caused different respiratory problems associated with sleep disorders and insomnia (Chen, 2014).
2.4. Wood

For wood is scientifically proven to have a positive effect on human health, whether as a tree or a raw material (Web 3). The benefits of wood in interiors are multiple physiological, psychological and environmental. Namely, wood in the interior improves a person's emotional state, lowers blood pressure (Sakuragawa et al., 2005), heart rate and stress level (Kelz et al., 2011), improves air quality, and in the long-term stores carbon and hereby helping to combat climate change. Figure 1 shows some of the benefits of wood usage in the interior (Web 2).

![Figure 1. Positive effects of wood in interiors](source: Web 2)

Along with many studies on how wood affects people, it is very difficult to find an objective scientific research results. Most of them are based on the subjective assessments of the respondents, which is not always a relevant data for the research evidence.

Healthy homes are the concept of healthy and natural landscaping where people live. Due to increasing concern for the environment and the impact of various health factors, people are increasingly choosing natural and healthy materials to decorate their home (Spetic et al., 2005). Users like to see wood in dining rooms, other rooms furniture, doors, kitchen cabinets, and floors, while the least attractive wood is to see them as wall coverings (Figure 2) (Rice et al., 2006).

The usage of wood proved positive attitudes in classrooms. The study (Kelz et al., 2011) proved that students who resided in a newly redecorated solid wood classroom had a much lower heart rate, unlike those in a classroom equipped standard materials. Ball et al. (2002) in New Zealand have proved the appearance of the working environment in offices can also affect people's work. Following the results, four of the top five ranked offices used wood in their interior design. The most common adjectives that describe ideal offices are: innovative, energetic and comfortable. As many as 95% of respondents said they would like to work in an office that has visible wood products in their indoor environment, suggesting that users love being surrounded by wood and for its aesthetics, comfort and sense of well-being.

However, not every type of wood has the same effect on human health and recovery, which is especially important when sleeping. The Pinus cembra is known as "Swiss pine" or "stone pine" and is often referred to by the people as the "queen of the Alps". Human Research's study (Web 3) estimates the effects of this type of wood on stress and the ability to recover in 30 adults. Healthy individuals, with differences in the quality of recovery seen in humans over time spent in a room equipped with pieces of furniture, wall and floor coverings made of Swiss
pine, and those who spent time in a room made of wood-imitating materials. The difference is express in lower heart rate during physical activity and mental stress, as well as in rest/autonomic recovery. In people who were staying in a room filled with wood-mimicking materials, the heart rate depended on atmospheric pressure, which was a sign of unstable circulation. It was not a case for people who were interviewed in a room whose interior is dominated by Swiss pine.

Figure 2. Mean preference ratings (and 95% confidence intervals) for wood used in various home applications (1 = wood is the least preferred material for this application; 5 = wood is the most preferred material for this application). Source: Rice et al., 2006

The second part of Human Research's study (Web 3) was based on the impact of the bed material on sleep quality. The test period was three weeks, and the subjects slept on a bed made of Swiss pine wood, then in their own bed or a bed made of wood-covered materials. The results showed a significant influence of the type of material on the physical and mental state of the subjects. Sleep quality was significantly improved when sleeping in a bed made of Swiss pine wood, as opposed to sleeping in a bed of foil-lined wood panels. The outcome of the study was a better recovery followed by a decreased heart rate as seen in Figures 3 and 4. The average saving was 3500 heart-beats per day, which corresponds to approximately one hour of "heart-work". In addition, the respondents gave their subjective opinion after sleeping in a bed made of Swiss pine wood. Almost all respondents stated that they felt more relaxed, generally more comfortable, and more socially extroverted (open, communicative) than before (Web 3).
Given today's hectic lifestyle and high exposure to stress, the influence of Swiss pine has a significant impact on the human body. Its use in interior design offers people quicker recovery and relaxation, and a peaceful and quality sleep during the night (Celinščak, 2019).

3. CONCLUSION

By choosing natural materials, in addition to not impact the environment, we can ensure even better sleep quality, as well as prevent some health disorders. The selection of materials for the bed system directly affects the health and sleep of the user.

Applying mostly synthetic materials such as polyurethane foam and synthetic fabrics in the upper layers of the mattress reduces the permeability and breathability of the bearing and thus does not fully meet the physiological requirements. In order to meet physiological requirements, moisture absorbent materials are used in the outer layer, they transport moisture in the inner layer, where hygroscopic materials are present. Those materials shortly retain moisture, which during daytime release into the environment.

An eco- and health-friendly bed system requires the use of natural materials, and for this reason, materials that are available in nature are wood, latex, cotton and sheep's wool.

Wood has a positive effect on human health. In addition to its beautiful appearance and positive effects on the emotional state of people, wood reduces stress, and has been shown to reduce heart rate. Due to its positive effects on human health, wood should be the main material for the design of the bed frame, but also in furnishing the interior. Considering nowadays fast lifestyle and high level of stress, the influence of natural solid wood has a significant impact on the human life.

Mattress materials can directly affect human sleep, dermatological problems, but can also affect the human musculoskeletal system. The materials used in the mattresses should be able to absorb moisture from the body and evaporate it into the environment, which means that must be used conductive and permeable materials. It is known that the human body secretes from 0.5 to 0.75 litres of fluid (according to some sources and 1.5 l) during sleep, so it is necessary that the mattress on which the body lies is permeable and breathable. For this reason, the selection of materials is based on cotton, wool, latex and wood.

latex is a natural soft and resilient material, with properties ideal for the mattress core. It offers comfort that adapts to a particular body shape, more precisely, supports the body that presses against it, and allows even distribution of mass on the surface. Such properties do not
cause an unpleasant counter-pressure on the body, but only the necessary ones, thus facilitating blood circulation, helping to reduce muscle and joint stiffness and helping the body to relax completely. Latex is an excellent natural replacement for artificial polyurethane foam.

Wool is a natural material of animal origin. It is a very good finer filler because it has good thermoregulatory properties. Its natural property is that it absorbs moisture and evaporates it. It also creates a dry and healthy sleeping climate. The wool fiber is permanently elastic, durable in shape and has very good anti-rheumatic properties. Such properties are bearable but retain their hardness which means that they withstand the human body and its pressures while providing quality support.

Cotton is a natural fiber and considered to be the dominant fabric in the bed system, it is good for human health because it successfully solves dermatological skin problems in atopic dermatitis. With its properties, cotton as a hygroscopic fiber and comfortable to the touch is great for the mattress surface layer which is in direct contact with the human body.

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Web 1: Trusted Clothes: Why organic cotton is better

Web 2: Planet Ark’s Make It Wood program: Wood housing, health, humanity