

2023年度 大麻纺织绿色发展报告

HEMP TEXTILE ECO-DEVELOPMENT REPORT



China Bast & Leaf Fibers Textile Association
中国麻纺织行业协会

报告说明

本报告是中国麻纺织行业协会发布的大麻纺织生态和社会责任报告。

报告主体

中国麻纺织行业协会

协作单位

汉泰纺织有限公司、高值特种生物资源产业技术创新战略联盟、
天津工业大学

报告范围

报告数据和信息涵盖了2023年前的大麻纺织生态和经济活动，并包含必要的历史信息。

信息来源

本报告所有信息和数据来自于中国麻纺织行业协会成员企业提供的情况汇总，由中麻协大麻专业委员会秘书处整理撰写。

发布形式和查询途径

报告语言为中英文，以印刷版和网络版两种形式发布。网络版可访问中国麻纺织行业协会官网www.cblfta.org.cn查询。协会成员可以对外宣传使用。

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大麻历史 及种植

■ 大麻基本介绍

中国参照欧盟标准，对大麻区分为“工业大麻”和“毒品大麻”，工业大麻指四氢大麻酚（THC）含量低于0.3%。纺织纤维用的大麻是工业大麻。

大麻种植简便，田间投入相对较少；对环境的适应能力极强，耐贫瘠、抗逆性强、适生性广；喜光照、光合作用效率高，生长迅速不需施肥；大麻作物生长过程需要500~700毫米的降水量，同时又抗干旱，如果在种植地区生长季节有降雨，基本无需额外灌溉。

大麻是一种对环境友善的经济作物。可以丰富土壤有机质，减少化肥投入，对农药具有吸附特性，有利于农业系统的可持续发展。大麻纤维可以用于纺织，也可用于造纸、建筑材料、复合材料等；大麻的种子火麻籽可以榨取火麻油用作烹饪，火麻仁除食用外还可以做成药材，如麻仁润肠丸。近年来，工业大麻的药用价值得到了许多国家的广泛关注，现已从大麻植株中分离出500多种化合物，主要包括大麻酚类化合物、多酚、有机酸、生物碱、萜类以及黄酮类等。其中，大麻酚类化合物被广泛研究和应用。大麻有两个主要成份，一四氢大麻酚(THC)和大麻二酚(CBD)，从工业大麻中生物提取无瘾非毒成分大麻二酚，具有抗痉挛、抗焦虑和抗炎的药理作用，是治病良药。

大麻纤维的应用在中国最为普遍和成熟。大麻纤维是一种纤维素韧皮纤维，存在于大麻植株的茎中，通过茎秆分离加工获取。大麻作为纺织原材料的应用起源于中国，素有“天然纤维之王”美誉，是一种功能性天然纤维。具有吸湿透气、防霉抑菌、吸附异味、抗辐射、抗紫外线、防静电等多项独特功能。大麻纤维同有机棉一样，是全球公认的生态环保纤维资源，非普通棉花、亚麻可以比拟。



中国大麻历史

大麻纤维是已知的最古老的纤维之一，作为纺织原材料的应用起源于中国，其应用在中国最为普遍和成熟，素有“天然纤维之王”美誉，据考古资料显示，中国最早驯化种植和利用大麻距今约5000-6000年，人们都称它为“国纺源头，万年衣祖”。

旧石器时期，人类直接使用兽皮、棕榈树皮以及麻纤维制成的简单编织物来遮蔽身体，并且使用骨针将细长的麻纤维当做线来缝合，串联兽皮和棕榈树皮等。

夏朝时期，我国最早的地理著作《尚书·禹贡》中载：“厥贡……岱畎，丝、枲、铅、松、怪石”，唐孔颖达注解：“枲，麻也……岱山之谷有此五物，美于他方所有，故贡之也。”说明大麻是泰山之特产，已作为进贡之品。

商朝时期，由于纺织品的发展，丝麻织品已占重要地位。

西汉时期，麻纺织技术已达到成熟阶段，马王堆汉墓一号出土的“素纱襌（dān）衣”以及麻纺织精品与丝织精品沿着“丝绸之路”进入中东、地中海、欧洲各国，继而走向全世界的历史足迹，都充分印证了，麻纺织在我国悠久的历史。

唐朝时期，人们以衣着特色，显示身份高低，麻衣在当时多为举人着装。

清朝时期，人们穿着的内衣，及外衣面料多使用纱、羽缎、麻等轻薄面料。

民国时期，各材质的纺织业已越来越发达，中国纺织学会成立，包括棉纺织、毛纺织、麻纺织和丝纺织等不同小组。

如今，我国大力发展纤维大麻种植，完善大麻纺织品加工产业链，不断创新提高大麻纺织加工技术，改善面料质感，大麻纺织品得以广泛推广使用。



纤维大麻种植

中国工业大麻的种植和加工需要通过公安部门的审批，目前有云南和黑龙江合法开放了工业大麻种植。2019年3月6日，国家禁毒委员会办公室发布《关于加强工业大麻管控工作的通知》，提出依据《1961年麻醉品单一公约》规定，大麻属于管制毒品，但该公约于1975年8月时明确指出：“本公约对于专供工业用途（纤维及种子）或园艺用途的大麻植物的种植不适用”。所以工业用大麻用途当前限于纤维和种子。我国作为《1961年麻醉品单一公约》缔约国，应遵守公约规定。

大麻种植简便，田间投入相对较少；对环境的适应能力极强，耐贫瘠、抗逆性强、适生性广；喜光照、光合作用效率高，生长迅速不需施肥；大麻作物生长过程需要500~700毫米的降水量，同时又抗干旱，如果在种植地区生长季节有降雨，基本无需额外灌溉。



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目前，中国大麻种植和利用方向主要是纤维大麻和籽用大麻。在大麻纺织业带动下，纤维大麻种植在近年迅猛发展，从2016年开始我国纤维大麻种植面积常年保持在30~40万亩，纤维产量约3~4万吨左右。纤维大麻种植主要集中在黑龙江省，其他省区如山西和吉林也有种植。黑龙江广袤的黑土地和气候条件非常适合工业化种植，是中国高品质雨露大麻的主要产地，2016年以来种植面积一直保持在25万亩以上。

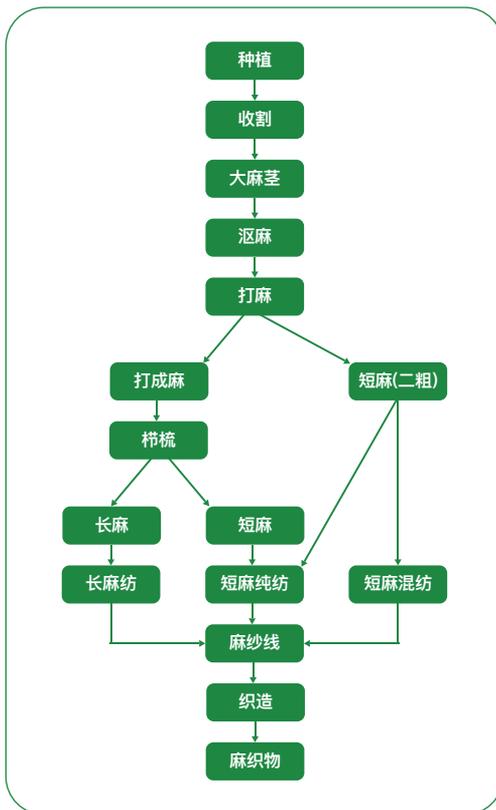
A close-up photograph of a textile machine processing raw flax fibers. The fibers are light brown and fibrous, being fed into a series of dark metal bobbins or spindles. The machine's components are dark and metallic, with a repeating pattern of bobbins. The background is blurred, showing more of the machine and the fibers.

大麻纺织 加工概况

■ 大麻纺织加工

目前，全世界只有中国、加拿大和德国等少数几个国家应用了大麻纤维纺织技术，中国处于国际领先水平。已形成包括由大麻种植、纤维加工、化工助剂、纺纱织造、服装家纺、黏胶纤维、造纸、汽车内饰、新型建材、复合材料、食品保健和活性炭等多个产业组成的大麻加工与应用产业链。中国工业大麻在“十三五”期间得到了快速发展。从2018年开始，国际上纷纷开放了工业大麻和医用大麻的种植及应用，国内和国际都对大麻产品的关注度空前高涨。国内工业大麻种植面积也快速增加，现已成为国内种植面积最大的麻类品种。

中国麻纺织业是我国传统纺织工业中最具国际竞争力的产业。在这个领域，中国拥有绝对领先优势，其麻纺织技术不仅延续了传统的亚麻纺纱路线和棉纺路线，更加以独特的方式进行了加工。



大麻纺织主要加工路径



■ 大麻纺织品特性

由于大麻纤维的特性决定了大麻织物有六大优越性：

大麻织物的吸湿透气性能

经过严格的脱胶处理后，大麻纤维的空腔较大，纵向具有许多裂隙和孔洞，并与中空相连。因此，大麻纤维能够有效吸湿透气。在干燥的春秋和冬季，大麻纤维能够提供良好的保暖性能，而在夏季则能给人带来凉爽的感受。一方面，大麻纤维中的亲水基团易于与水分子结合和吸附水分子，其松散分子结构和中空形状能够充填大量毛细管凝结水，从而使大麻纤维具有较强的吸湿能力；另一方面，大麻纤维表面覆盖着密布的裂隙和孔洞，有利于水分的散湿。因此，大麻纺织品非常适合用于服装和家纺产品。

大麻织物的防静电性能

大麻纤维分子结构稳定，分子排列有良好的取向度，因此具有极低的静电能力。干燥的大麻纤维是电的不良导体，其绝缘性能优于棉纤维。在相同测试条件下，纯大麻织物的静电压高于麻棉混合布约两倍，并且高于涤麻混纺布。大麻纤维具有良好的吸湿性能，含水率一般保持在12%左右。在空气湿度达到95%时，其含水率可达30%，但手感并不潮湿。因此，大麻纺织品能够轻松避免静电积聚，不会因机械加工或衣着摆动摩擦而引起尘埃吸附、起毛起球或放电。大麻纤维的比电阻高于棉纤维，防静电性能良好。

大麻织物的柔软舒适性

大麻纤维的单纤长度为15-25毫米，细度为15-30微米，比重为1.48，轻于亚麻。大麻纤维的单纤断裂强度也优于亚麻和棉。大麻纤维的分子结构呈纵向排列，紧密整齐，结晶度和定向度较高。大麻纤维是各种麻类纤维中最细的一种，接近棉纤维，且端部呈钝角形状。因此，经过棉型化处理后，大麻纤维面料具有极为柔软的手感，无需特别处理即可避免其他麻类产品的刺痒感和粗糙感。

大麻织物的抗菌抑菌性能

大麻纤维具有多孔的结构和强大的吸附能力。在自然状态下，大麻纤维吸附大量氧气，破坏厌氧菌的生存环境，从而具有抗菌的优势。此外，大麻织物能够快速排出人体汗液，破坏细菌生存所需的潮湿环境，表现出较高的抑菌性能。大麻植物中还含有多种活性酚类物质、有机酸和无机盐，对多种细菌具有明显的杀灭和抑制作用。根据中国军事医学科学院微生物流行病学研究所的测试，大麻织物对金黄色葡萄球菌、绿脓杆菌、大肠杆菌、白色念珠菌等微生物具有抑菌效果。

大麻织物的抗紫外及吸音消波性能

大麻织物具有出色的抗紫外线辐射性能。这主要归因于大麻纤维的横截面形状不规则，中空呈线形或椭圆形，以及分子结构中的螺旋线纹和多棱状结构。当光波或声波射入大麻纤维时，会在结晶区形成漫反射和多层光折射，从而在纤维分子的无定形区、缝隙和孔洞处吸收和破坏光波或声波，使大麻织物具有良好的防紫外线辐射功能。根据中国科学院物理研究所的测试，一般大麻织物无需特别处理即可屏蔽大部分紫外线。

大麻织物的吸附性能

大麻纤维具有出色的化学吸附性能。与棉纤维相比，大麻纤维在甲醛、苯和TVOC等方面的吸附能力更强。这是由于大麻纤维的多孔结构增大了比表面积，从而显著提高了吸附性能。

■ 大麻纺织行业概况



在2019年的《国家产业结构调整指导目录》中，明确将“符合生态、资源综合利用与环保要求的特殊天然纤维产品加工”纳入纺织行业鼓励类条目。

目前，大麻纺织行业已经建立了完整的制造链和自主知识产权核心技术，包括从大麻脱胶、梳理、纺纱、织造到服装、家纺和产业用纺织等领域。其研发技术和制造水平处于世界领先地位。中国目前拥有世界上最先进的大麻长麻纺生产线和大麻混纺生产线，并且还有一座光伏电能覆盖全部厂房的大麻纺织绿色示范工厂。

由于大麻纤维具有绿色可持续发展的特点，它经常与棉花、莫代尔和再生聚酯等环保纤维进行混纺，以突显大麻混纺面料的绿色环保特色。



在众多大麻纺织企业的不断努力下，大麻纺织产品的种类越来越丰富，其在国际市场上的认可度也在不断提升。据统计，2020年大麻纱布的累计出口量较2016年增长了30.97%；2022年大麻纱累计出口1234.96吨，金额1462.20万美元；大麻机织布累计出口386.41万米，金额2143.55万美元，大麻纱、大麻机织布合计出口金额3605.75万美元，同比提高33.39%。尽管与亚麻纺织产品相比，大麻纺织品的出口数量和金额还较低，但却呈现持续增长的趋势，大麻出口市场未来可期。

近年来，随着人们生活质量的提高，绿色环保和回归自然的时尚潮流逐渐兴起。作为一种绿色环保的生态纤维，大麻面料除了具备天然的功能特性外，还展现出了尊贵高雅、朴实无华和自然实用等风格。因此，大麻纺织品在绿色环保理念和广泛的麻文化消费基础上拥有着深厚的市场潜力。



大麻纺织 与可持续发展

■ 绿色发展和可持续性

绿色发展是以效率、和谐、可持续为目标的经济增长和社会发展方式，是在传统发展基础上的一种模式创新，是建立在生态环境容量和资源承载力的约束条件下，将环境保护作为实现可持续发展重要支柱的一种新型发展模式。当今世界，绿色发展已经成为一个重要趋势，绿色发展与可持续发展在思想上是一脉相承的，既是对可持续发展的继承，也是可持续发展中国化的理论创新，也是中国特色社会主义应对全球生态环境恶化客观现实的重大理论贡献，符合历史潮流的演进规律。

中国“绿色现代化”三步走的战略中，第一步是建设“资源节约型、环境友好型社会”。这一步骤的目标是通过提高资源利用效率、减少环境污染和生态破坏，实现经济发展与环境保护的协调；第二步：2020年到2030年应该进入到CO₂大规模减排阶段，力争将2030年的CO₂排放量降到2005年的水平；第三步：2030年到2050年实现CO₂排放量的进一步大幅下降，并且与世界同步。



在新的形势下，中国纺织行业提出了“创新驱动的科技产业、文化引领的时尚产业、责任导向的绿色产业”新发展方向，与大麻纺织产业“绿色、低碳、可持续”的发展之路高度契合。大麻纺织行业在国家2030年前实现碳排放达峰、2060年前实现碳中和目标导向下，广泛宣传大麻产业“绿色、低碳、可持续”的发展理念，加大大麻产品的综合利用开发，巩固与提高行业核心竞争力，推进大麻纺织行业可持续发展。

大麻纺织将是纺织行业绿色发展的典型代表。未来，全行业将凝聚共识，将发展立足于国家生态战略全局之中，将可持续发展作为价值提升的重要途径和纺织强国应有之责。

■ 绿色发展的机遇和挑战

全球气候治理形势紧迫，突显出了对大麻纺织业积极参与推进社会责任建设和可持续发展的迫切需求，以应对全球气候变化所带来的新挑战。

全球气候变暖所带来的环境生态风险已经成为人类生存面临的最严重威胁之一，减少二氧化碳排放已成为大麻产业从业者共同肩负的责任。中国麻纺织行业协会将逐步推动将环境责任纳入行业的价值体系、创新体系和管理体系，以有效推动行业的绿色可持续发展。

在大麻纤维作为亚麻纤维替代品的潜力逐渐显现的同时，构建起可追溯的绿色供应链体系成为推动大麻纺织产业全面发展的重要手段。大麻种植的碳汇优势和大麻纺织的绿色可持续理念，作为经济增长的新动力，将为大麻纺织行业的快速发展提供重要支持。

随着我国全面小康社会目标的实现，国内居民人均纤维消费量达到了中等发达国家的水平。在国内消费升级的大趋势引领下，人们对绿色、健康、安全和舒适的需求越来越成为纺织品和服装的基本生活需求。人们对安全与健康的重视程度不断增加，绿色消费的趋势将为纺织行业在国内形成正确的市场导向，使其能够在双循环经济的背景下实现良好的发展。

■ 碳排放挑战和应对措施

碳排放问题是当前全球关注的焦点之一。碳排放通常指的是温室气体排放，其中CO₂是最主要的一种，CO₂排放量被广泛用来量化碳排放情况。自21世纪以来，全球碳排放量呈迅猛增长趋势，全球碳排放挑战形势严峻。发展中国家的快速工业化和城市化使得碳排放问题更加突出，这些国家往往依赖高碳能源和高污染产业，导致碳排放不断增加；同时，工业化发达国家也面临着碳排放削减的压力，减少碳排放需要投入大量的资金和技术，并涉及到各个行业和领域的改革。因此，行业科技创新与国际合作成为解决碳排放挑战的关键。



■ 强化纤维大麻绿色种植和加工

中国目前尚未制定全国性的工业大麻法律法规，因此工业大麻在全国范围内仍未被全面合法化。目前有关工业大麻的规定分散在农业部、国家发展和改革委员会、商务部以及各省地发布的文件中，并且多个政策法规对工业大麻的发展有严格的限制。然而，纤维大麻已经在多个省份合法种植，中国麻纺织行业协会将继续在黑龙江、山西等地推进纤维大麻种植和综合加工，合理控制种植规模，循序渐进稳步发展，并推广大麻综合利用技术。

为了推动大麻产业的发展，需要进行科技创新，包括品种及其种源繁育、种植技术、专用机械研制、原料加工新技术、生产工艺、产品研发和综合利用等方面。同时，还需要加强各环节之间的合作，建设创新平台载体，培育优势品种，重点推进工业大麻的绿色生产和产业新应用开发。

在能源优化方面，需要引导和支持企业进行低耗能、低耗水项目建设，鼓励企业继续提高二次能源消费比重。此外，还可以利用太阳能等可再生能源作为补充能源，推动企业进行CO₂排放量核算。同时，还需要树立大气污染物排放和碳排放消减的“双降”示范企业样板，鼓励采用智能化技术装备，提高劳动生产率。此外，还需要加快制定行业节能低碳标准，鼓励进行厂房绿色设计。

■ 推广先进绿色制造技术

以绿色技术为驱动，旨在降低产业链上各个环节的污染物排放量，实现全过程的系统性污染防治。我们将加大力度进行清洁生产方面的改造，持续减少关键的污染物排放，包括化学需氧量、氨氮和氮氧化物等。同时，我们积极推广先进适用的生物脱胶技术、节水工艺和高效装备，以提升对水资源的高效利用。针对大麻纤维加工企业和纺织企业，我们鼓励其推动研发出少水、少化学品的加工工艺，同时加大对循环水、再生水等非常规水资源的开发力度。此外，我们还将加强用水管理和水系统的集成优化工作，并进一步创建一批具有典型意义的绿色加工示范项目和标杆企业。通过这些措施，我们将不断推动产业链的绿色化发展，为环境保护和可持续发展做出贡献。

■ 引导大麻产业科技创新

在推动大麻产业实现低碳发展方面，持续的科技创新是必不可少的解决方案。其中，大麻纺织和综合利用被视为创新的重要方向。通过对综合利用技术进行创新，大麻产业将能够提高产品附加值，并在新材料、新能源技术以及工艺等“绿色”领域展现出卓越的表现。

在大麻产业中，纺织业是一个具有巨大潜力的领域。利用大麻纤维制造纺织品不仅有助于降低环境负担，还能够为消费者提供高品质的可持续产品。通过研究和发展纺织技术，我们可以进一步改进纺织品的性能和质量，并推动大麻纺织在时尚、家居和其他领域的广泛应用。



■ 加强国际间合作与交流

共同减少碳排放是全球所面临的共同挑战，这需要全球各国政府、企业、社会各界以及不同行业的合作与共同努力。我们应当加强合作与交流，共同推动碳排放的减少。同时，科技创新也将推动大麻产业发展朝着新材料和新能源技术的方向迈进。举例来说，我们可以利用大麻植物提取出的纤维来制造环保型的复合材料，广泛应用于汽车制造和航空航天等领域。此外，在生物质能源领域，大麻也具备巨大潜力，可以用于生产生物燃料和生物质能源，替代传统的化石燃料，从而实现更加清洁和可持续的能源供应。

总而言之，大麻产业在低碳发展方面有着巨大的潜力，而这离不开持续的科技创新。通过加大对大麻纺织和综合利用技术的研究和发展，我们可以进一步提高大麻产品的附加值，并在“绿色”领域中展现出更加卓越的表现。相信随着科技的不断进步，大麻产业必将迎来更加辉煌的发展。

大麻纺织的 环境友好特性



■ 纤维大麻与环境友好性

麻纤维是绿色环保的植物纤维，种类丰富，主要包括大麻、亚麻、苧麻和黄麻等，各种麻纤维虽然有相似的地方，但都存在各自优势的领域，在纺织领域应用都非常广泛。

纤维大麻环境友好性突出

大麻在种植、培育、加工环节实现了环境友好，其适应力极强，需要更少的能源和水，并且没有病虫害，几乎不要施肥、打药，可减少农药和杀虫剂等易造成温室气体高排放的化学药剂的使用，且大麻叶在回田后可生物降解，养分易被土壤吸收。加拿大东部谷物与油料研究中心评估了23种作物生态友好性，在这些作物中，纤维大麻排在第5位，对环境友好性具有积极作用。亚麻排在第9位，棉花排在第17位，它们对环境友好性产生负面影响。

纤维大麻从种植到收获整个过程，每吨大麻排放的CO₂量约是棉花的1/3。大麻更易于生物降解和回收利用。大麻作物通常具有3-5米的高度，且可以快速再生，仅3个月就能长到4米。大麻的种植可以利用丘陵、山坡等，充分利用土地优势，同时适当轮作可减少轮作农作物的虫害和病害，施肥量有限，生产成本较低；它生长用水量比棉花少30%，它可以将60%-70%的养分返回土壤，为来年的作物更好地施肥；同时，大麻对害虫和杂草有天然的抵抗力，不需要杀虫剂、化肥或化学品；根据法国测试方法：种植1公顷大麻在100天的生长周期内可以在纤维素碳中隔离并储存20吨的CO₂，并且在土壤中隔离并贮存另外500kgCO₂，因此采用大麻制造的产品也称为“碳汇产品(CO₂ Sink Products)”。从可持续性的角度来看，大麻纤维绝对是环保纤维之首。

大麻纤维性能突出

大麻纤维是取大麻韧皮经脱胶加工而成的纤维素纤维，单纤维长度15-25mm，纤维呈现精细、浅色和光泽感，具有柔软亲肤，吸湿透气、清爽速干、防霉抑菌、抗紫外线、防静电和抗过敏等突出特性，是典型的绿色保健纤维。

在绿色可持续性方面，大麻是一种多用途、高附加值、可再生的经济作物，大麻韧皮纤维可以替代棉花，秆芯可以代替木材，广泛应用于纺织、建筑和汽车等行业；大麻籽可以替代石油制造生物柴油，性能与石化柴油相当；大麻混凝土不但坚固耐用、防火防潮，还具有吸附CO₂的功能。

大麻纤维是功能特性突出的低碳环保可持续发展天然纤维材料，已成为全球公认的生态环保特色珍贵资源。

■ 大麻纺织与环境

进入20世纪后，随着纺织品需求的激增和绿色生态纺织品推广，纺织纤维原料在增长上遭遇诸多困难，面临必须走“可再生、可降解、可循环、符合环境要求、符合可持续发展和其他产业和谐协调”的开发道路。在这种大环境促使下，由20世纪70年代起，世界许多国家的农业科技工作者，转变思路，克服困难，采用生物新技术，着力培育低毒或无毒的大麻品种。经过十余年的努力，先后培育出近30个品种，其THC含量由一般高毒品种的5%-17%降到0.3%以下，失去了毒品吸食或提取的效益，实现了工业大麻的合法种植基础，纤维大麻加工也蓬勃发展。

大麻纤维在麻类中属优等的纺织原料，作为最坚韧的天然纤维，大麻经久耐用基于它独特内在的纤维特质。它耐洗且具有卓越的抗紫外线能力，这使得其比任何其他天然纤维都能保留颜色的耐久性；同时，坚韧的大麻纤维还是所有麻类中最柔软的一种，而且能和棉、天丝、再生涤纶、毛等纤维混纺；更为重要的是，大麻是可以抗菌的优良纤维，是理想的户外及运动装的材料。



绿色大麻纺织的 现在与未来

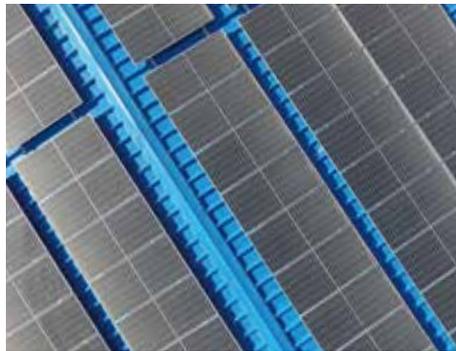
绿色工厂实践



大麻纺织绿色示范工厂

随着全球多重危机导致燃料价格飙升，如今人们开始将来自本地的免费清洁能源视为最可靠的投资选择。为了优化能源结构，越来越多的企业开始充分利用太阳能等绿色能源，并在厂房屋顶建设分布式光伏发电项目。在追求科技创新和绿色发展的推动下，企业正逐步实施转型升级，以实现稳健高质量的生产经营，这已经成为纺织行业现在和未来的主要发展思路。

作为一家专注于绿色发展的纺织企业，汉泰纺织有限公司采取了一系列环保措施推进绿色经营模式。他们在厂房天台上铺设了光伏设备，并更新了先进的节能设备，通过电机系统能效提升、设施效率提高和新的节能生产工艺开发等手段来提高能源利用效率。该公司充分利用光伏绿色清洁能源，为其乳山工厂提供超过70%的电力供应。汉泰纺织有限公司开发大麻与多种环保纤维如有机棉、再生涤纶、再生纤维素纤维混纺产品，生产出更多高品质环保的大麻纺织品。



在大麻纺织行业的发展中，环保理念也显得尤为重要。企业需要遵循“减量化、再利用、再循环”的原则，将循环经济的理念贯穿于大麻纺织服装的设计、生产、销售和消费以及包装运输等各个环节。具体到大麻原料生产、染整加工和服装加工等步骤，企业应积极利用大麻等可再生和可降解资源，减少纺织余料的浪费等问题。此外，企业还应明确产品的定位和实际需求，避免质量过剩、使用维护成本过高、产品包装过度以及回收再生难度大等问题的出现，从而提高大麻资源的利用率，减少大麻产业链中的资源浪费和环境污染。这种做法有助于推动绿色大麻纺织行业的弹性发展，将企业发展与国家生态战略相结合，同时也是纺织强国应有的责任和重要途径。

环保大麻纤维纺织产品

随着消费者对健康环保纺织品的需求日益增加，大麻纤维纺织行业正迎来巨大的发展机遇。大麻纤维作为一种温室气体排放更低的天然可持续性纤维，备受广大消费者的喜爱，其市场份额也在逐渐提高。根据美国行业市场研究公司宜必思世界（IBISWorld）的报告，2018年，中国大麻纤维服装行业的市场规模达到了41.8亿元，而预计在2023年，这一数字将达到62.3亿元。国家对环保纺织行业和有机农业的投资也在不断增加，导致大麻纺织品的品牌和企业不断增多。因此，可以预见，大麻纤维纺织行业未来将继续保持良好的发展势头。



■ 可持续产业链建设

纺织加工对健康和环境带来一些影响，特别是水和空气污染问题。因此，迫切需要采用环保的新制造方法，以确保纺织工业与环境的协调发展。在这方面，使用环保纤维材料是实现可持续发展的最简单和可靠的方式之一。因此，越来越多的人开始关注大麻的生态经济价值。国家政策也开始支持麻纺行业的发展。

目前，中国已成为全球大麻种植面积最大的国家，大麻种植面积约占全球种植总面积的50%左右，年均产量约占全球产量的25%。中国适宜大麻种植的地区范围广泛，但合法种植尚未得到大规模开放。大麻种植简单，具有很强的适应性，喜光且对日照时间要求较短，适宜产区分布在北纬45–55°之间，最佳生长温度为14–27°C。中国目前已经形成了云南以花叶用、黑龙江以纤维用、山西以籽粒用为主的工业大麻产业布局。其中，黑龙江省是我国主要的纤维大麻产地，占全国总面积约60%。2022年，全省工业大麻种植面积约为25万亩，主要分布在黑河、齐齐哈尔、绥化等地。黑龙江省的大麻纤维产量达到2万多吨，纤维质量最为优良，得益于其得天独厚的地理位置。

大麻产业链可分为上游种植、中游加工和下游应用三个部分。在产业链的下游，主要利用提取出的大麻原材料制成大麻纺织品。根据大麻咨询公司New Frontier Data的数据估算，按中性假设计算，在2020年，全球大麻行业的市场规模约为294亿美元。预计到2024年，这个规模将增加至587亿美元。大麻纤维在纺织业市场上具有优异的柔软透气性、天然抑菌性、紫外线防护性、防静电性和耐热性等特点，因此其市场前景良好。将可持续发展视为提升价值的重要途径和纺织强国的责任所在，将发展立足于国家生态战略全局之中。

特别鸣谢：

汉泰纺织有限公司

为本次报告的发布提供的大力协助

我们坚定地认为：

大麻纤维是绿色纤维

大麻纤维是大自然给我们最好的礼物



Description

This report is an ecological and social responsibility report on hemp textiles published by the China Bast & Leaf Fibers Textile Association

Reporter

China Bast & Leaf Fibers Textile Association

Collaborators:

Hempfortex Textile Co Ltd.
High Value Special Bioresource Industry Technology Innovation Strategic Alliance.
Tianjin University of Technology.

Scope of the report

The data and information in the report cover the ecological and economic activities of hemp textiles up to 2023 and include the necessary historical information.

Sources of information

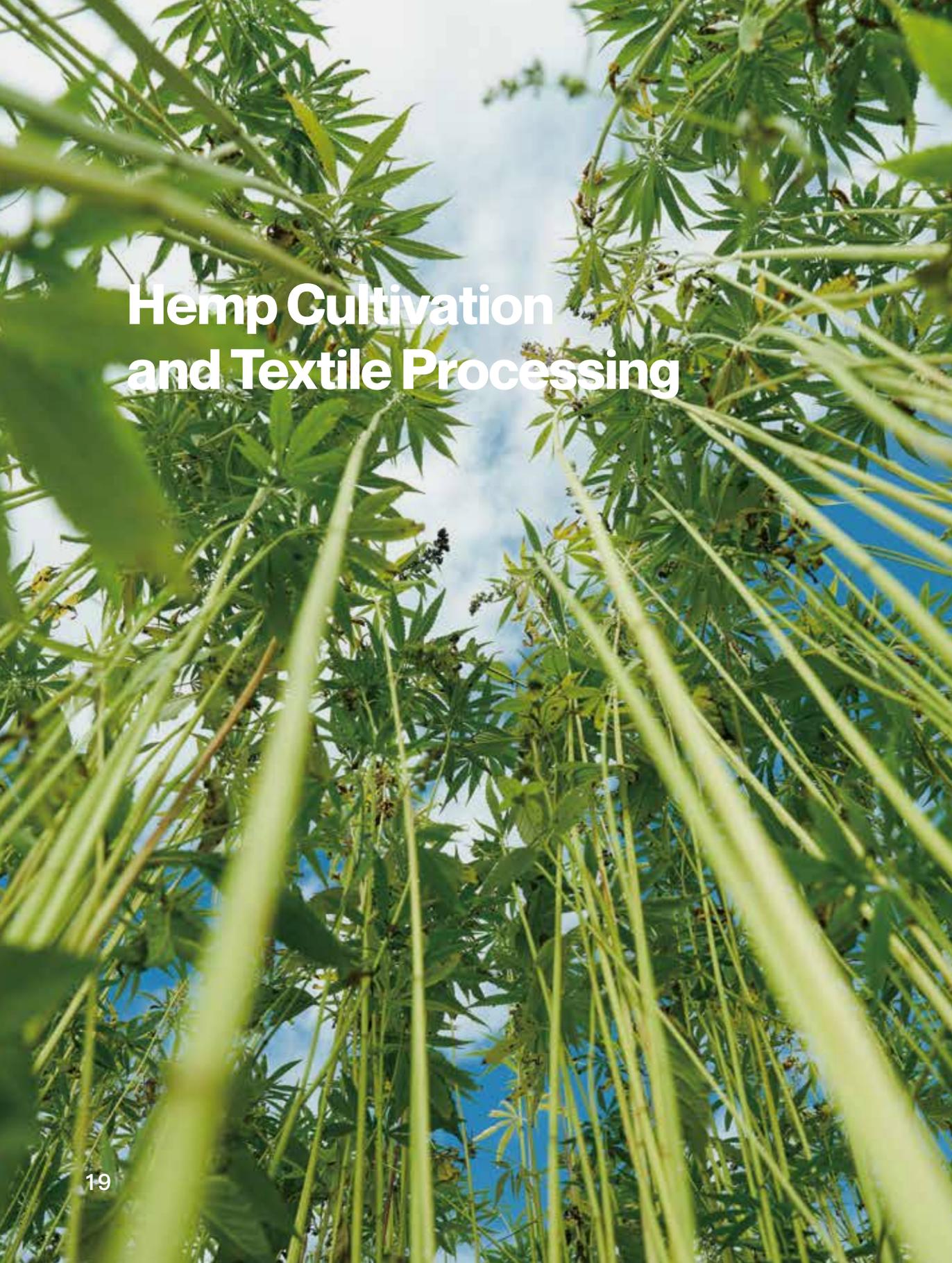
All information and data in this report come from a summary of the situation provided by collaborators mentioned on part I. and were compiled and written by the Secretariat of China Bast & Leaf Fibers Textile Association

Publication format and access

The report is available in both English and Chinese, and is published in both print and online formats. The online version can be found on the website of the China Bast & Leaf Fibers Textile Association (www.cblfta.org.cn). Members of the Association can use the report external publicity.

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Hemp Cultivation and Textile Processing

Introduction to Hemp

Hemp, also known as fire hemp, Chinese hemp, male hemp (male plants), or tho (female plants), is an annual plant of the mulberry family cannabis; the entire plant can be used in its entirety. The entire industrial hemp plant can be fully utilized and is generally classified into three categories: fiber hemp, oil hemp, and medicinal hemp. Here, we primarily focus on fiber hemp. Hemp fiber is one of the earliest textile fibers used by humans, and China is one of the earliest countries to cultivate hemp. In ancient China, hemp was already an important crop and was referred to as one of the "Five Grains," which included hemp, millet, barley, wheat, and soybeans.

In China, following the European Union standards, hemp is classified into "industrial hemp" and "marijuana," with the main differences being:

1) Marijuana contains a high level of the psychoactive compound tetrahydrocannabinol (THC), which can induce hallucinogenic effects. The THC content in marijuana ranges from 5% to 20% and in some cases, can reach 25% to 30%. In contrast, industrial hemp has a THC content lower than 0.3% (the primary distinction).

2) Appearance: Marijuana plants are short and bushy, resembling shrubs, while industrial hemp plants are tall and slender, with some reaching heights of up to 6 meters.

3) Leaf structure: Marijuana leaves are broad and grow close to the buds, whereas industrial hemp leaves are narrow and typically grow at the top of the plant.

4) The cultivation conditions for industrial hemp and marijuana also differ significantly. Industrial hemp can be grown in fields with relatively low environmental requirements, while marijuana is often cultivated in controlled environments such as greenhouses, where temperature, humidity, and lighting conditions need to be carefully regulated.

5) Industrial hemp has been legalized in Yunnan and Heilongjiang provinces in China, while marijuana remains classified as a drug and is illegal.

There are over 3,000 different types of hemp products worldwide, widely used in industries such as textiles, papermaking, food, pharmaceuticals, construction, and automotive. The scope of applications for hemp is continually expanding.



History of Hemp in China

Hemp is one of the oldest known fibers, and its use as a textile material originated in China. Its application in China is the most widespread and mature, earning it the “King of Natural Fibers” reputation. According to archaeological evidence, the earliest cultivation and use of hemp in China dates back approximately 5000–6000 years, and it is often referred to as the “origin of national textile, ancestor of clothing for thousands of years.”

During the Paleolithic period, humans used simple woven materials from animal skins, palm tree bark, and hemp fibers to cover their bodies. They used bone needles to sew together the long hemp fibers as threads, connecting animal skins and palm tree bark. During the Shang Dynasty, silk and hemp textiles had already become essential. By the Western Han Dynasty, hemp textile technology had matured. The discovery of the “plain gauze robe” and exquisite hemp and silk textiles in the No. 1 tomb of the Mawangdui Han Dynasty, as well as the historical traces of hemp and silk textiles entering the Middle East, the Mediterranean and various European countries along the Silk Road, all fully demonstrate the long cultural history of hemp textiles in China. During the Tang Dynasty, clothing was used to display social status, and scholars commonly wore hemp clothing. In the Qing Dynasty, lightweight fabrics such as yarn, feather satin, and hemp were widely used for underwear and outerwear. During the Republican era, textile industries of various materials became increasingly developed, and the China Textile Society was established, including different groups for cotton, wool, hemp, and silk textiles. After the Sino–Vietnamese border self–defense counterattack on February 17, 1979, the military supply department quickly researched new textile fibers by the central government’s instructions, and “hemp” began to be used as a military product.

Today, China is vigorously developing the hemp fiber crop and hemp textile processing industry chain, continuously optimizing clothing technology, fabric texture, and more cultivation and application characteristics.



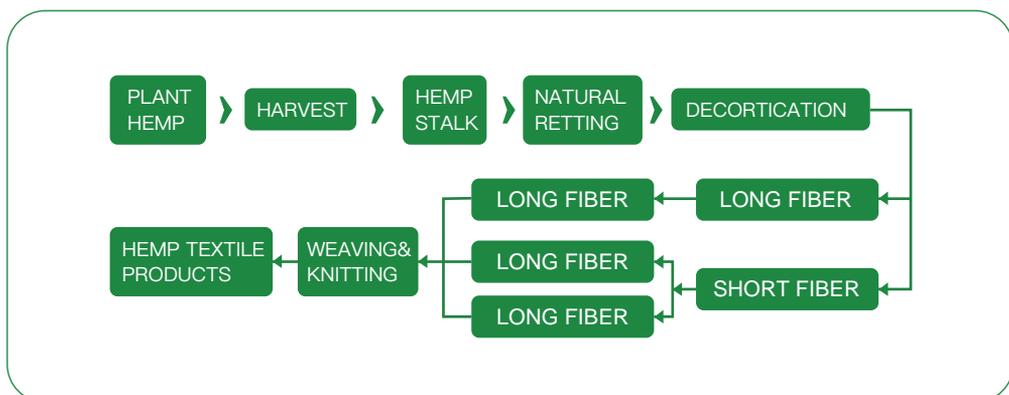
Cultivation of Hemp Fiber

Only a few countries, such as China, Canada, and Germany, have applied hemp fiber textile technology, with China leading the way internationally. A hemp processing and application industry chain has been formed, including hemp cultivation, fiber processing, chemical additives, spinning and weaving, clothing and home textiles, adhesive fibers, papermaking, automotive interiors, new building materials, composite materials, food and health care, and activated carbon. Chinese industrial hemp has experienced rapid development during the “13th Five-Year Plan” period. Since 2018, there has been a global opening up of industrial hemp and medical cannabis cultivation and application, leading to unprecedented attention both domestically and internationally for cannabis products. The domestic industrial hemp cultivation area has also rapidly increased and has become the most extensive variety of hemp cultivated domestically.



Hemp textile processing route

China’s hemp textile industry stands out as the most globally competitive among its traditional textile advantages. With cutting-edge technology, Chinese hemp textile production follows both the traditional flax spinning route and the traditional cotton spinning route.



Hemp textile properties

Due to the unique characteristics of hemp fibers, hemp textiles possess six exceptional properties:

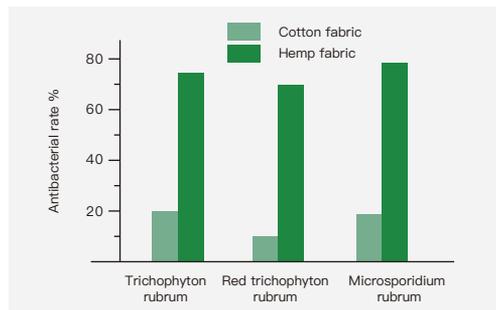
(1) Hemp textiles have excellent moisture absorption and breathability properties.

After undergoing rigorous degumming treatment, hemp fibers have large cavities, numerous cracks, and holes that are connected to the central cavity. As a result, hemp fibers can effectively absorb moisture and allow air to pass through. During dry seasons like spring, autumn, and winter, hemp fibers provide good insulation, while in summer, they offer a cool sensation. On one hand, the hydrophilic groups in hemp fibers easily combine with and adsorb water molecules. The loose molecular structure and hollow shape of hemp fibers can hold a significant amount of capillary condensed water, giving them strong moisture absorption capabilities. On the other hand, the surface of hemp fibers is covered with dense cracks and holes, facilitating the dispersion of moisture. Therefore, hemp textiles are highly suitable for clothing and home textile products.



(2) Hemp fabrics possess antibacterial and inhibitory properties.

Hemp fibers have a porous structure and strong adsorption capacity. In their natural state, hemp fibers adsorb a large amount of oxygen, disrupting the living environment of anaerobic bacteria and thus exhibiting antibacterial advantages. Additionally, hemp fabrics can quickly wick away sweat from the body, disrupting the moist environment necessary for bacterial survival and demonstrating high inhibitory properties. Hemp plants also contain various active phenolic compounds, organic acids, and inorganic salts, which have significant bactericidal and inhibitory effects on multiple bacteria. According to tests conducted by the Institute of Microbiology and Epidemiology at the Chinese Academy of Military Medical Sciences, hemp fabrics have antibacterial effects against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, and other microorganisms.



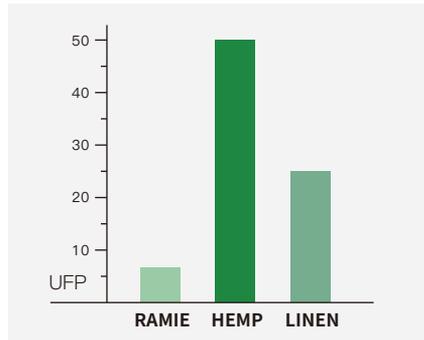
Comparison of the antibacterial properties between hemp fabric and cotton fabric

(3) The anti-static properties of hemp fabric.

The molecular structure of hemp fibers is stable, and they have a well-oriented molecular arrangement, which gives them a very low static electricity ability. Dry hemp fibers are poor conductors of electricity and have better insulation properties than cotton fibers. Under the same testing conditions, pure hemp fabric has a static voltage that is about twice as high as hemp-cotton blend fabric and higher than polyester-hemp blend fabric. Hemp fibers have good moisture absorption properties, with a moisture content typically maintained at around 12%. When the air humidity reaches 95%, the moisture content can reach 30%, but the fabric does not feel damp. Therefore, hemp textiles can easily avoid static electricity accumulation and do not attract dust, lint, or discharge due to mechanical processing or clothing movement. The resistivity of hemp fibers is higher than that of cotton fibers, indicating good anti-static performance.

(4) Anti-UV and sound absorption and wave performance of hemp fabric

Hemp fabric exhibits excellent anti-UV radiation performance. This is mainly attributed to the irregular cross-sectional shape of hemp fibers, which have linear or elliptical hollows, and the helical and multi-faceted structures in their molecular composition. When light waves or sound waves penetrate hemp fibers, they undergo diffuse reflection and multiple refractions within the crystalline regions, resulting in the absorption and disruption of the waves at the amorphous regions, gaps, and pores of the fibers. This imparts hemp fabric with effective protection against UV radiation. According to tests conducted by the Institute of Physics, Chinese Academy of Sciences, most hemp fabrics can naturally block a significant portion of UV rays without requiring any special treatment.



Ultraviolet Protection Index UPF values for several flax fabrics^a

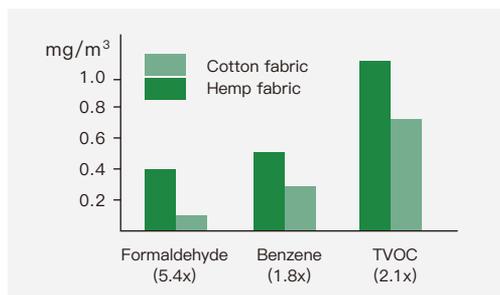
(5) The soft and comfortable performance of hemp fabrics

Hemp fibers have a single fiber length of 15–25 millimeters, a fineness of 15–30 micrometers, and a specific gravity of 1.48, which is lighter than flax. The tensile strength of hemp fibers is also superior to flax and cotton. The molecular structure of hemp fibers is longitudinally arranged, tightly organized, and exhibits high crystallinity and orientation. Hemp fibers are the finest among various types of bast fibers, similar to cotton fibers, and have blunt ends. Therefore, after undergoing cottonization treatment, hemp fabric has an extremely soft hand feel and does not require any special treatment to avoid the itchiness and roughness associated with other types of bast fiber products.



(6) The adsorption properties of hemp fabrics

Hemp fabric exhibits excellent chemical adsorption performance. Compared to cotton fibers, hemp fibers have a stronger adsorption capacity for substances such as formaldehyde, benzene, and TVOC. This is due to the porous structure of hemp fibers, which increases the specific surface area and significantly enhances the adsorption performance.



Comparison of the adsorption of formaldehyde, benzene and TVOC of hemp and cotton



Overview of the Hemp Textile Industry

In the 2019 edition of the "Guidance Catalog for Industrial Structure Adjustment," the processing of "special natural fiber products that meet ecological, resource utilization, and environmental protection requirements" was included in the encouraged category for the textile industry.

Currently, the hemp textile industry has established a complete manufacturing chain and possesses core technologies with independent intellectual property rights. This includes areas such as hemp retting, combing, spinning, weaving, as well as clothing, home textiles, and industrial textiles. Its research and development technology and manufacturing level are at the forefront globally. As of the end of 2020, China's hemp textile production capacity is roughly as follows: 20,000 tons/year for hemp fiber retting, 40,000 spindles for long hemp spinning, and approximately 150,000 spindles for hemp blending (regular).

China currently has the most advanced production lines for long hemp spinning and hemp blending in the world, as well as a hemp textile green demonstration factory with photovoltaic power covering all its facilities.

Due to the green and sustainable characteristics of hemp fibers, they are often blended with environmentally friendly fibers such as organic cotton, modal, and recycled polyester to highlight the green and eco-friendly features of hemp blended fabrics.

With the continuous efforts of numerous hemp textile enterprises, the variety of hemp textile products is becoming increasingly diverse, and their recognition in the international market is continuously improving. According to statistics, the cumulative export volume of hemp yarn and fabric in 2020 increased by 30.97% compared to 2016. Although the export quantity and value of hemp textiles are still relatively low compared to flax products, they are showing a trend of continuous growth.

In recent years, with the improvement of people's quality of life, the fashion trend of green and eco-friendly and a return to nature has gradually emerged. As a green and eco-friendly ecological fiber, hemp fabric not only possesses natural functional characteristics but also exhibits styles of nobility, simplicity, and practicality. Therefore, hemp textiles have significant market potential based on the concepts of green and eco-friendly and the widespread consumption of hemp culture.



A tall, slender hemp plant with characteristic serrated green leaves and a developing seed pod (inflorescence) at the top. The plant is set against a clear, bright blue sky. The text "Hemp Textiles and Sustainable Development" is overlaid in white on the upper left portion of the plant.

Hemp Textiles and Sustainable Development

Green Development and Sustainability

Green development is an economic growth and social development approach that aims for efficiency, harmony, and sustainability. It is an innovative model built upon traditional development, and it is based on the constraints of ecological capacity and resource carrying capacity. Green development sees environmental protection as a crucial pillar for achieving sustainable development. In today's world, green development has become an important trend. It is closely related to the concept of sustainable development, inheriting its principles and contributing to the localization of sustainable development theory in the context of Chinese socialism. It is also a significant theoretical contribution to addressing the objective reality of global ecological degradation and aligns with the laws of historical evolution.

In China's "green modernization" strategy, there are three steps. The second step, from 2020 to 2030, focuses on large-scale reduction of CO₂ emissions, aiming to reduce CO₂ emissions to the level of 2005 by 2030. The third step, from 2030 to 2050, aims for further significant reduction of CO₂ emissions, synchronizing with the rest of the world.

In the face of new circumstances, China's textile industry has proposed a new development direction of "innovation-driven technological industry, culture-led fashion industry, and responsibility-oriented green industry." This aligns well with the "green, low-carbon, and sustainable" development path of the hemp textile industry. Under the guidance of national goals to achieve peak carbon emissions before 2030 and carbon neutrality before 2060, the hemp textile industry widely promotes the concept of "green, low-carbon, and sustainable" development, increases comprehensive utilization and development of hemp products, strengthens and enhances the industry's core competitiveness, and promotes the sustainable development of the hemp textile industry.

Hemp textile will serve as a typical representative of green development in the textile industry. In the future, the entire industry will unite in consensus, basing its development on the national ecological strategy, and considering sustainable development as an important path to enhance value and fulfill the responsibilities of a textile powerhouse.



■ Opportunities and Challenges of Sustainability

The urgent situation of global climate governance highlights the pressing need for the hemp textile industry to actively participate in promoting social responsibility and sustainable development to address the new challenges brought about by global climate change.

The environmental and ecological risks brought about by global climate warming have become one of the most serious threats to human survival. Reducing carbon dioxide emissions has become a shared responsibility of practitioners in the hemp industry. The China Hemp Textile Industry Association will gradually promote the integration of environmental responsibility into the industry's value system, innovation system, and management system to effectively promote the industry's green and sustainable development.

As the potential of hemp fiber as a substitute for flax fiber gradually emerges, the construction of a traceable green supply chain system has become an important means for the industry association to promote the comprehensive development of the hemp textile industry. The carbon sequestration advantages of hemp cultivation and the green and sustainable concept of hemp textile, as a new driving force for economic growth, will provide important support for the rapid development of the hemp textile industry.

With the realization of the goal of a moderately prosperous society in China, the per capita fiber consumption of domestic residents has reached the level of moderately developed countries. Under the trend of consumption upgrading in the domestic market, people's demand for green, healthy, safe, and comfortable products is becoming increasingly important. The emphasis on safety and health is continuously increasing, and the trend of green consumption will create the correct market orientation for the textile industry in China, enabling it to achieve good development in the context of a circular economy.



Carbon Emission Challenges and Mitigation Measures

The issue of carbon emissions is one of the current global focuses. Carbon emissions typically refer to greenhouse gas emissions, with CO₂ being the most significant one. The amount of CO₂ emissions is widely used to quantify carbon emissions. Since the 21st century, global carbon emissions have been rapidly increasing, posing a severe challenge worldwide. The rapid industrialization and urbanization of developing countries have made the issue of carbon emissions more prominent. These countries often rely on high-carbon energy and high-pollution industries, leading to continuously increasing carbon emissions. At the same time, industrialized developed countries also face pressure to reduce carbon emissions. Reducing carbon emissions requires significant investment in funds and technology, and involves reforms in various industries and sectors. Therefore, industry technological innovation and international cooperation become key to addressing the challenge of carbon emissions.



Strengthening the green cultivation and processing of industrial hemp fibers

China currently does not have a nationwide industrial hemp law and regulations, so industrial hemp has not been fully legalized nationwide. Currently, regulations regarding industrial hemp are scattered in documents issued by the Ministry of Agriculture, the National Development and Reform Commission, the Ministry of Commerce, and provincial governments, and multiple policies and regulations impose strict restrictions on the development of industrial hemp. However, the cultivation of fiber hemp has been legalized in several provinces, and the China Hemp Textile Industry Association will continue to promote the cultivation and comprehensive processing of fiber hemp in places like Heilongjiang and Shanxi, controlling the scale of cultivation reasonably, gradually, and steadily developing, and promoting the comprehensive utilization technology of hemp.

Technological innovation is needed to promote the development of the hemp industry, including breeding of varieties and their sources, cultivation techniques, development of specialized machinery, new technologies for raw material processing, production processes, product research and development, and comprehensive utilization. At the same time, it is necessary to strengthen cooperation between various links, establish innovative platform carriers, cultivate superior varieties, and focus on promoting green production of industrial hemp and the development of new industrial applications.

Regarding energy optimization, it is necessary to guide and support enterprises in low-energy and low-water consumption project construction and encourage enterprises to continue increasing the secondary energy consumption proportion. In addition, renewable energy, such as solar energy, can be used as supplementary energy to promote the calculation of CO₂ emissions by enterprises. At the same time, it is necessary to establish "dual reduction" demonstration enterprises to reduce atmospheric pollutants and carbon emissions, encourage intelligent technology and equipment use, and improve labor productivity. Furthermore, it is necessary to accelerate the formulation of industry energy-saving and low-carbon standards and encourage green design of factories.

■ Promoting advanced green manufacturing technology

Driven by green technology, we aim to reduce the emissions of pollutants at every stage of the industrial chain and achieve systematic pollution prevention and control throughout the entire process. We will intensify efforts to transform clean production and continuously reduce key pollutant emissions, including chemical oxygen demand, ammonia nitrogen, and nitrogen oxides. At the same time, we actively promote advanced and applicable biodegradation technology, water-saving processes, and efficient equipment to enhance the efficient utilization of water resources. For hemp fiber processing and textile enterprises, we encourage the development of processing techniques that require less water and fewer chemicals while increasing efforts to develop unconventional water resources such as recycled water and reclaimed water. In addition, we will strengthen water management, optimize water systems, and further create several exemplary green processing demonstration projects and benchmark enterprises. Through these measures, we will continuously promote the green development of the industrial chain and contribute to environmental protection and sustainable development.

■ Guiding technological innovation in the hemp industry

Continuous technological innovation is essential for promoting low-carbon development in the hemp industry. Among them, hemp textile and comprehensive utilization are important innovation directions. By innovating in comprehensive utilization technology, the hemp industry will be able to increase the added value of products and demonstrate outstanding performance in "green" areas such as new materials, new energy technologies, and processes.

The textile sector in the hemp industry has excellent potential. Using hemp fibers to manufacture textiles helps reduce environmental burdens and provides consumers with high-quality, sustainable products. Through research and development of textile technology, we can further improve the performance and quality of textiles and promote the widespread application of hemp textiles in fashion, home furnishings, and other fields.

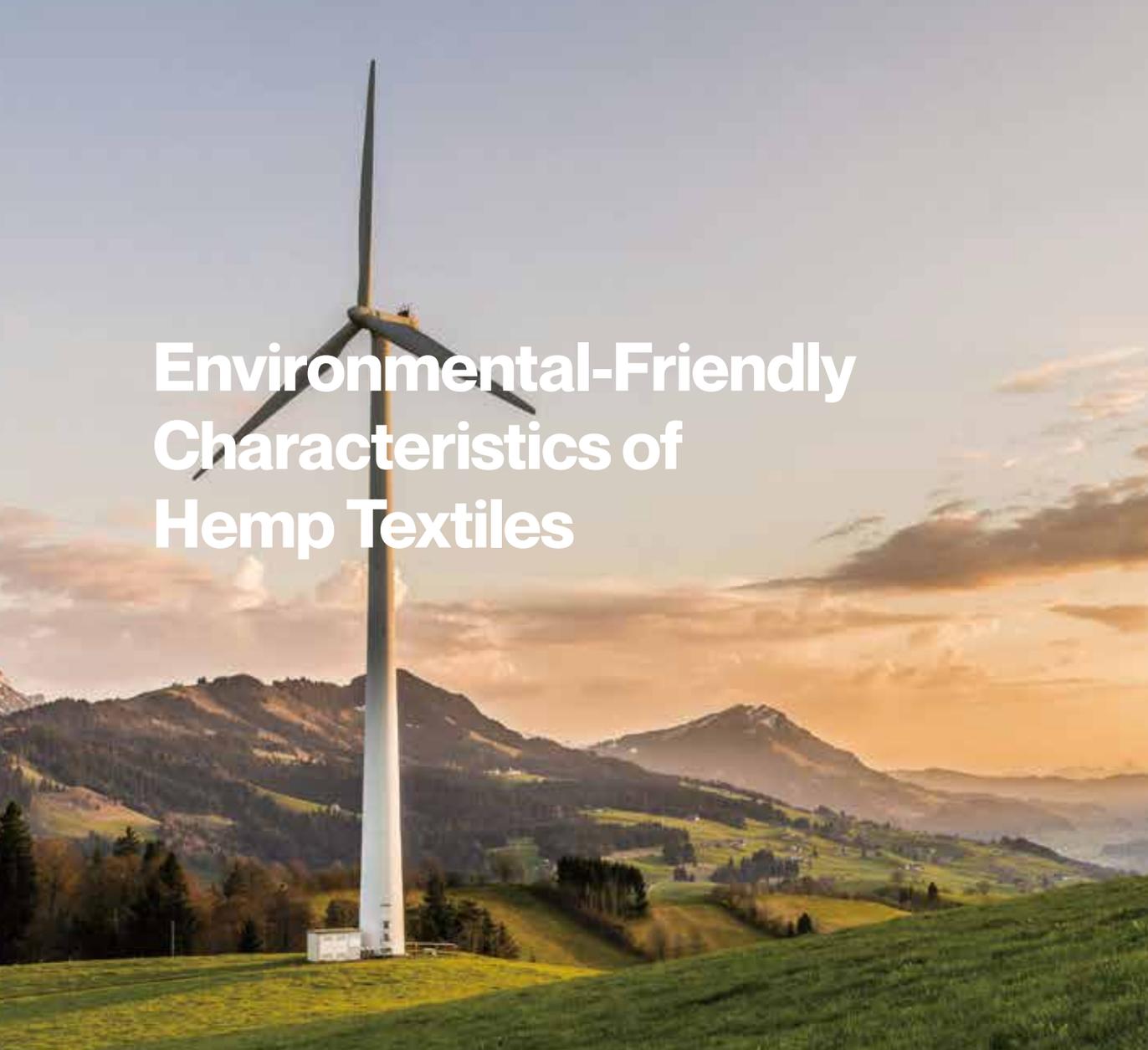


Strengthening international cooperation and exchanges

Reducing carbon emissions together is a common challenge the world faces, requiring cooperation and joint efforts from governments, businesses, society, and different industries worldwide. We should strengthen cooperation and exchanges to promote the reduction of carbon emissions jointly. At the same time, technological innovation will also drive the development of the hemp industry towards new materials and new energy technologies. For example, we can use fibers extracted from hemp plants to manufacture environmentally friendly composite materials widely used in automotive manufacturing and aerospace industries. In addition, in the field of biomass energy, hemp has great potential. It can produce biofuels and biomass energy, replacing traditional fossil fuels and achieving cleaner and more sustainable energy supply.

In conclusion, the hemp industry has tremendous potential for low-carbon development, which cannot be achieved without continuous technological innovation. By increasing research and development in hemp textile and comprehensive utilization technologies, we can further increase the added value of hemp products and demonstrate outstanding performance in "green" areas. With the continuous progress of technology, we believe that the hemp industry will usher in a more brilliant development.



A large white wind turbine stands on a grassy hill. The background features rolling green hills and mountains under a sunset sky with orange and yellow clouds. The turbine's three blades are visible, and the overall scene is peaceful and natural.

Environmental-Friendly Characteristics of Hemp Textiles

■ Exploring The Eco-Friendliness Of Hemp Fiber

Hemp fiber is a green and environmentally friendly plant fiber with a wide variety of types, including hemp, flax, and ramie. Although various types of hemp fibers have similarities, they each have their advantages in different fields and are widely used in the textile industry.

Hemp fiber exhibits outstanding performance.

Hemp fiber is a cellulose fiber obtained by processing the bast of the hemp plant. With a single fiber length of 15–25mm, hemp fibers are fine, light-colored, and lustrous. They possess remarkable characteristics such as softness, moisture absorption, breathability, quick drying, mold and bacteria resistance, UV protection, anti-static properties, and hypoallergenic. It is a typical green and health-promoting fiber.

In terms of green sustainability, hemp is a versatile, high-value, and renewable cash crop. Hemp bast fibers can replace cotton, and hemp stalks can substitute for wood, finding wide applications in the textile, construction, and automotive industries. Hemp seeds can be used as a substitute for petroleum in biodiesel production, with performance comparable to petrochemical diesel. Hempcrete, a type of concrete made from hemp, is not only durable and fire and moisture resistant but also has the ability to absorb CO₂.

Flax and other fibers, compared to traditional cotton, are more easily biodegradable and recyclable. They require less energy, water, and fertilizer, and emit fewer nitrates into the atmosphere. Hemp cultivation, cultivation, and processing have been made environmentally friendly. Hemp is highly adaptable, resistant to pests and diseases, requires minimal fertilization and pesticide use, reducing the use of chemical agents that contribute to high greenhouse gas emissions. Additionally, hemp leaves can biodegrade after returning to the field, allowing nutrients to be easily absorbed by the soil. Throughout the entire process from cultivation to harvest, hemp emits approximately one-third of the CO₂ compared to cotton.

Hemp fiber is a low-carbon, environmentally friendly, and sustainable natural fiber material with outstanding functional properties. It has become a globally recognized ecological and precious resource.

■ The Impact Of Hemp Textiles On The Environment

In the 20th century, with the increasing demand for textiles, the growth of textile fiber raw materials faced many difficulties and had to follow the path of "renewable, degradable, recyclable, environmentally friendly, sustainable, and harmonious with other industries". In response to this environment, agricultural scientists in many countries around the world began to change their thinking and overcome challenges by using biotechnology to cultivate low-toxic or non-toxic varieties of hemp. After more than a decade of efforts, nearly 30 varieties have been developed, with THC content reduced from 5%–17% in high-toxic varieties to below 0.3%, losing the benefits of drug use or extraction, thus giving rise to industrial hemp (hemp for fiber).

Hemp fiber is considered a top-grade textile material among all types of hemp. As the most durable natural fiber, hemp is long-lasting due to its unique inherent fiber characteristics. It is resistant to washing and has excellent UV resistance, making it more colorfast than any other natural fiber. Additionally, hemp fiber is the softest among all types of hemp and can be blended with cotton, silk, recycled polyester, wool, and other fibers. Furthermore, hemp is an excellent antibacterial fiber, making it an ideal material for outdoor and sportswear.

Hemp crops typically reach heights of 3–5 meters and can regenerate quickly, growing up to 4 meters in just three months. Hemp cultivation can make use of hilly and sloping land, fully utilizing the advantages of the soil. Proper crop rotation can reduce pest and disease problems, limit fertilizer usage, and lower production costs. Hemp requires 30% less water than cotton and can return 60%–70% of nutrients to the soil, providing better fertilization for the following year's crops. Moreover, hemp has natural resistance to pests and weeds, eliminating the need for pesticides, fertilizers, or chemicals. According to French testing methods, planting one hectare of hemp can isolate and store 20 tons of CO₂ in cellulose carbon during a 100-day growth cycle, and an additional 500 kg of CO₂ can be isolated and stored in the soil. Therefore, products made from hemp are also known as "CO₂ Sink Products". Hemp is also biodegradable and can be used as garden mulch. From a sustainability perspective, hemp is undoubtedly the leading environmentally friendly fiber.



Present and Future of Hemp Textiles

■ Implementing Green Practices In Hemp Textile Factories

As multiple global crises have led to soaring fuel prices, people are now considering locally sourced, free clean energy as the most reliable investment option. To optimize energy structures, more and more companies are harnessing green energy, such as solar power, and implementing distributed photovoltaic projects on the roofs of their factories. Driven by the pursuit of technological innovation and green development, companies are gradually transforming and upgrading to achieve stable and high-quality production and operation, which has become the main development strategy for the textile industry now and in the future.

As a textile company focused on waste reduction and energy conservation, Hemp Fortex Industries, Ltd. has taken several measures to improve its operational model. They have installed photovoltaic equipment on the rooftops of their factories and replaced outdated energy-saving equipment. The company has achieved better energy utilization by improving energy efficiency through measures such as motor system efficiency enhancement, facility efficiency improvement, and the development of new energy-saving production processes. Additionally, the company fully utilizes green and clean solar energy, which provides over 70% of the power supply for its factory in Rushan. With the support of solar energy, the workshop has sufficient electrical power to help Hemp Fortex Industries, Ltd. operate efficiently and produce more high-quality and environmentally friendly hemp textiles.

In the development of the hemp textile industry, environmental protection concepts are fundamental. Companies need to adhere to the principles of "reduction, reuse, and recycling" and integrate the circular economy concept into the design, production, sales, and consumption of hemp textiles. In specific steps such as hemp raw material production, dyeing and finishing processes, and garment processing, companies should actively utilize renewable and degradable resources such as hemp and reduce waste of textile scraps. Furthermore, companies should clearly define the positioning and actual needs of their products to avoid issues such as excessive quality, high maintenance costs, excessive product packaging, and difficulties in recycling and regeneration. This will improve the utilization rate of hemp resources, reduce resource waste and environmental pollution in the hemp industry chain. Such practices contribute to the resilient development of the green hemp textile industry, aligning corporate development with national ecological strategies, and are also the responsibility and important approach for a textile powerhouse.



Hemp Textile Green Demonstration Factory

■ Environmentally Friendly Hemp Fiber Textile Products

With the increasing demand for eco-friendly textiles, the hemp fiber textile industry is experiencing significant growth opportunities. Hemp fiber, known for its lower greenhouse gas emissions and sustainability, is gaining popularity among consumers, leading to an increase in market share. According to a report by the American industry market research company IBISWorld, the market size of China's hemp fiber clothing industry reached 4.18 billion yuan in 2018, and it is projected to reach 6.23 billion yuan by 2023. The government's investment in the environmental textile industry and organic agriculture is also contributing to the growth of hemp textile brands and companies. Therefore, it is expected that the hemp fiber textile industry will continue to thrive in the future.

■ Building A Sustainable Industry Chain For Green Hemp Textiles

The textile industry has a significant impact on health and the environment, particularly in terms of water and air pollution. Therefore, it is urgent to adopt environmentally friendly manufacturing methods to ensure the coordinated development of the textile industry and the environment. In this regard, the use of environmentally friendly fiber materials is one of the simplest and most reliable ways to achieve sustainable development. As a result, more and more people are beginning to pay attention to the ecological and economic value of hemp. National policies are also starting to support the development of the hemp textile industry.

Currently, China has become the country with the largest hemp cultivation area in the world, accounting for about 50% of the global cultivation area, with an annual output of about 25% of the global production. China has a wide range of suitable areas for hemp cultivation, but legal cultivation has not yet been widely opened. Hemp cultivation is simple and highly adaptable, requiring light and shorter daylight hours. Suitable production areas are distributed between 45–55° north latitude, with the optimal growth temperature being 14–27°C. China has already established a hemp industry layout with Yunnan focusing on flower and leaf use, Heilongjiang focusing on fiber use, and Shanxi focusing on seed use. Heilongjiang Province is China's main hemp-producing region, accounting for about 60% of the total area. In 2019, the industrial hemp cultivation area in the province was approximately 13,300 hectares, mainly distributed in areas such as Heihe, Qiqihar, and Suihua. In the same year, the hemp production in Heilongjiang Province reached 16,000 tons, with the highest quality fiber, thanks to its unique geographical location.



The hemp industry chain can be divided into upstream cultivation, midstream processing, and downstream applications. In the downstream part of the industry chain, raw hemp materials are mainly used to produce hemp textiles. According to data estimated by hemp consulting company New Frontier Data, the global hemp industry had a market size of approximately \$29.4 billion in 2020, and it is projected to increase to \$58.7 billion by 2024. Hemp fiber has excellent characteristics in the textile market, such as softness, breathability, natural antibacterial properties, UV protection, anti-static properties, and heat resistance, making its market prospects promising.

The development of hemp textiles should follow the principles of "reduction, reuse, and recycling," integrating the concept of a circular economy into the design, research and development, production, processing, sales, and consumption of hemp textiles. Specifically, in producing raw hemp materials, dyeing and finishing processes, and garment production, renewable and degradable resources such as hemp should be actively utilized to reduce the waste of textile residues and other issues. Clear product positioning and actual needs should be defined to avoid problems such as excessive quality, high maintenance costs, excessive product packaging, and difficulties in recycling and regeneration. Improving the utilization rate of hemp resources, reducing resource waste and environmental pollution that may occur in the hemp industry chain, and promoting the flexible development and vigorous growth of the green hemp textile industry. Considering sustainable development as an important means to enhance value and the responsibility of a textile powerhouse, development should be based on the overall national ecological strategy.

Special Acknowledgments:

Hemp fortex Industries Ltd.

Strong assistance provided for the release of this report

We strongly believe that:

Hemp fiber is a green fiber

Hemp fiber is nature's best gift to people



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